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LIST OF SESSIONAL PAPERS

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(This volume is bound in three parts.)

1. Report of the Auditor General for the year ended 31st March, 1916. Volume 1, Parts a, b and A to K; Volume II, Parts L to U; Volume III, Parts V to Z; Volume IV, Part ZZ. Presented by Sir George Foster April 19, 1917.

Printed for distribution and sessional papers.

CONTENTS OF VOLUME 2.

2. The Public Accounts of Canada, for the fiscal year ended March 31, 1916. Presented by Sir Thomas White, February 1, 1917...*Printed for distribution and sessional papers.*

3. Estimates of sums required for the service of the Dominion for the year ending on the 31st March, 1918, and in accordance with the provisions of "The British North America Act, 1867," the Governor General recommends these Estimates to the House of Commons. Presented by Sir Thomas White, January 31, 1917.

Printed for distribution and sessional papers.

4. Supplementary Estimates of sums required for the service of the Dominion for the year ending on the 31st March, 1917, and, in accordance with the provisions of "The British North America Act, 1867," the Governor General recommends these Estimates to the House of Commons. Presented by Sir Thomas White, February 5, 1917.

Printed for distribution and sessional papers.

5. Supplementary Estimates of sums required for the service of the Dominion for the year ending on the 31st March, 1918. Presented by Sir Thomas White, August 17, 1917.

Printed for distribution and sessional papers.

6. List of Shareholders in the Chartered Banks of the Dominion of Canada as on December 31, 1915. Presented by Sir Thomas White, January 25, 1917.. .. ..*Not printed.*

7. Report on certified cheques, drafts or bills of exchange, dividends remaining unpaid and unclaimed balances in Chartered Banks of the Dominion of Canada, for five years and upwards prior to December 31, 1915. Presented by Sir Thomas White, January 25, 1917.. .. .. .

CONTENTS OF VOLUME 4.

10. Report of the Department of Trade and Commerce for the fiscal year ended 31st March, 1916: Part I.—Canadian Trade (Imports in and Exports from Canada). Presented by Sir George Foster, April 19, 1917.. ..*Printed for distribution and sessional papers.*

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10*a*. Report of the Department of Trade and Commerce for the fiscal year ended March 31, 1916:—Part II.—Canadian Trade with France, Germany, the United Kingdom and the United States. Presented by Sir George Foster, January 25, 1917.
Printed for distribution and sessional papers.

10*b*. Report of the Department of Trade and Commerce for the fiscal year ended March 31, 1916.—Part III.—Canadian Trade with British and Foreign Countries (except France, Germany, United Kingdom and United States). Presented by Sir George Foster, April 19, 1917... .. ..*Printed for distribution and sessional papers.*

10*c*. Report of the Department of Trade and Commerce for the fiscal year ended March 31, 1916 (Part IV, Miscellaneous Information). Presented by Sir George Foster, June 4, 1917.. .. ..*Printed for distribution and sessional papers.*

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10*d*. Report of the Department of Trade and Commerce, Part V—Grain Statistics, compiled by the Inspection Branch of the Department, Ottawa, for the fiscal year ended March 31, 1916, the crop year ended August 31, 1916, and the season of navigation ended December 14, 1916; and Report of the Board of Grain Commissioners. Presented by Sir George Foster, June 8, 1917.. .. *Printed for distribution and sessional papers.*

10*e*. Report of the Department of Trade and Commerce, for the fiscal year ending March 31, 1916 (Part VI.—Subsidized Steamship Services, with Statistics showing Steamship Traffic to December 31, 1916, and Estimates for fiscal year 1917-1918). Presented by Sir George Foster, May 3, 1917.. ..*Printed for distribution and sessional papers.*

10*f*. Report of the Department of Trade and Commerce for the fiscal year ended March 31, 1916: Part VII—Trade of Foreign Countries, Treaties and Conventions. Presented by Sir George Foster, 1917.. .. ..*Printed for distribution and sessional papers.*

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11. Report of the Department of Customs for the year ended March 31, 1916. Presented by Hon. Mr. Reid, January 29, 1917.. ..*Printed for distribution and sessional papers.*

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12, 13, 14. Reports, Returns and Statistics of the Inland Revenues of the Dominion of Canada, for the fiscal year ended March 31, 1916. Part I.—Excise. Part II.—Weights and Measures, Gas and Electricity. Part III.—Adulteration of Food. Presented by Sir James Lougheed, January 26, 1917...*Printed for distribution and sessional papers.*

15. Report of the Minister of Agriculture for the Dominion of Canada, for the year ended March 31, 1916. Presented by Hon. Mr. Burrell, January 26, 1917.
Printed for distribution and sessional papers.

15*a*. Report of the Dairy and Cold Storage Commissioner for the fiscal year ending March 31, 1916. (Dairying, Fruit, Extension of Markets and Cold Storage.) Presented by Hon. Mr. Burrell, 1917.. .. ..*Not printed.*

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15*b*. Report of the Veterinary Director General for the year ending March 31, 1916. Presented by Hon. Mr. Burrell, 1917... .. ..*Printed for distribution and sessional papers.*

15*c*. Report on "The Agricultural Instruction Act," 1915-16, pursuant to Section 3, Chapter 5 of 3-4 George V. Presented by Hon. Mr. Patenaude, January 31, 1917.
Printed for distribution and sessional papers.

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16. Report of the Director and Officers of the Experimental Farms for the year ending 31st March, 1916.—Volumes I, II and III. Presented by Sir George Foster, August 13, 1917.
Printed for distribution and sessional papers.

17. Criminal Statistics for the year ended September, 1915. (Appendix to the Report of the Minister of Trade and Commerce for the year 1915.) Presented by Sir George Foster, 1917. .. ..*Printed for distribution and sessional papers*

18. Return of By-elections for the House of Commons of Canada held during the year 1916. Presented by Hon. Mr. Speaker, 1917.. .. ..*Not printed.*

CONTENTS OF VOLUME 10.

19. Report of the Minister of Public Works on the works under his control for the fiscal year ended March 31, 1916. Presented by Hon. Mr. Rogers, January 26, 1917.
Printed for distribution and sessional papers.

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20. Annual Report of the Department of Railways and Canals, for the fiscal year from April 1, 1915, to March 31, 1916. Presented by Hon. Mr. Cochrane, April 19, 1917.
Printed for distribution and sessional papers.

20*a*. Canal Statistics for the season of Navigation, 1916. Presented by Hon. Mr. Reid, May 7, 1917... .. ..*Printed for distribution and sessional papers.*

20*b*. Railway Statistics of the Dominion of Canada, for the year ended 30th June, 1916. Presented by Hon. Mr. Cochrane, April 24, 1917.
Printed for distribution and sessional papers.

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20*c*. Eleventh Report of the Board of Railway Commissioners for Canada, for the year ending 31st March, 1916. Presented by Hon. Mr. Cochrane, January 23, 1917.
Printed for distribution and sessional papers.

20*d*. Telephone Statistics of the Dominion of Canada, for the year ended June 30, 1916. Presented by Hon. Mr. Cochrane, April 19, 1917.
Printed for distribution and sessional papers.

20*e*. Express Statistics of the Dominion of Canada, for the year ended June 30, 1916. Presented by Hon Mr. Cochrane, April 25, 1917.
Printed for distribution and sessional papers.

20*f*. Telegraph Statistics of the Dominion of Canada, for the year ended June 30, 1916. Presented by Hon. Mr. Cochrane, April 19, 1917.
Printed for distribution and sessional papers.

20*g*. Report of the Royal Commission appointed to consider the general problem of transportation in Canada, comprising:—Report of Sir H. F. Drayton and Mr. W. M. Acworth; Report of Mr. A. H. Smith; and, Appendices A and B, being Report of Appraisal of Canadian Northern Railway System and Grand Trunk Pacific Railway, by Mr. Geo. F. Swain, C.E. Presented by Sir Thomas White, May 2, 1917.
Printed for distribution and sessional papers.

CONTENTS OF VOLUME 13.

21. Forty-ninth Annual Report of the Department of Marine and Fisheries, for the year 1915-16—Marine. Presented by Hon. Mr. Hazen, January 23, 1917.
Printed for distribution and sessional papers.

22. List of Shipping issued by the Department of Marine and Fisheries, being a list of vessels on the Registry Books of the Dominion of Canada, on the 31st day of December, 1916. Presented by Hon. Mr. Hazen, September 4, 1917.
Printed for distribution and sessional papers.

23. Supplement to the Forty-ninth Annual Report of the Department of Marine and Fisheries for the fiscal year 1915-16. (Marine)—Steamboat Inspection Report. Presented by Hon. Mr. Hazen, April 19, 1917... ..*Printed for distribution and sessional papers.*

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24. Report of the Postmaster General for the year ended 31st March, 1916. Presented by Hon. Mr. Blondin, February 1, 1917...*Printed for distribution and sessional papers.*

25. Annual Report of the Department of the Interior, for the fiscal year ending March 31, 1916. Presented by Hon. Mr. Roche, January 22, 1917.
Printed for distribution and sessional papers.

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25*b*. Annual Report of the Topographical Surveys Branch of the Department of Interior, 1915-16. Presented by Hon. Mr. Roche, June 19, 1917.
Printed for distribution and sessional papers.

25*c*. Report of Hydrometric Surveys (Stream Measurements), for the calendar year 1915. Presented by Hon. Mr. Roche, April 19, 1917.
Printed for distribution and sessional papers.

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25*d*. Fifteenth Report of the Geographic Board of Canada for year ended March 31, 1916. Presented, 1917.. .. ..*Not printed.*

25*e*. Report of the British Columbia Hydrometric Survey for the calendar year 1915 (Water Resources Paper No. 18 of the Dominion Water Power Branch, Department of the Interior). Presented by Hon. Mr. Roche, July 5, 1917.
Printed for distribution and sessional papers.

25*f*. Progress Report of the Manitoba Hydrometric Survey for the calendar year 1915 (Water Resources Paper No. 19 of the Dominion Water Power Branch, Department of the Interior). Presented by Hon. Mr. Roche, July 7, 1917.
Printed for distribution and sessional papers.

CONTENTS OF VOLUME 17.

26. Summary Report of the operations of the Geological Survey, Department of Mines, for the calendar year, 1916. Presented by Hon. Mr. Meighen, August 28, 1917.
Printed for distribution and sessional papers.

26*a*. Summary Report of the Mines Branch of the Department of Mines, for the calendar year ending 31st December, 1915. Presented by Hon. Mr. Patenaude, April 19, 1917.
Printed for distribution and sessional papers.

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27. Report of the Department of Indian Affairs for the year ended March 31, 1916. Presented by Hon. Mr. Roche, January 22, 1917.
Printed for distribution and sessional papers.

28. Report of the Royal Northwest Mounted Police, 1916. Presented by Sir Robert Borden, April 19, 1917.. .. ..*Printed for distribution and sessional papers.*

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29. Report of the Secretary of State of Canada for the year ended March 31, 1916. Presented by Hon. Mr. Roche, August 18, 1917... ..*Printed for distribution and sessional papers.*

30. The Civil Service List of Canada for the year 1916. Presented 1917.
Printed for distribution and sessional papers.

31. Eighth Annual Report of the Civil Service Commission of Canada for the year ended August 31, 1916. Presented by Hon. Mr. Patenaude, April 19, 1917.
Printed for distribution and sessional papers.

32. Annual Report of the Department of Public Printing and Stationery for the fiscal year ended March 31, 1916. Presented by Sir Robert Borden, July 31, 1917.
Printed for distribution and sessional papers.

33. Report of the Secretary of State for External Affairs for the year ended March 31, 1917. Presented 1917... .. ..*Printed for distribution and sessional papers.*

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34. Report of the Minister of Justice as to the Penitentiaries of Canada for the fiscal year ending March 31, 1916. Presented 1917...*Printed for distribution and sessional papers.*

35. Report of the Militia Council for the Dominion of Canada, for the fiscal year ending March 31, 1916. Presented by Sir A. E. Kemp, February 3, 1917.
Printed for distribution and sessional papers.

36. Report of the Department of Labour for the fiscal year ending March 31, 1916. Presented by Hon. Mr. Crothers, January 22, 1917.
Printed for distribution and sessional papers.

36a. Ninth Report of the Registrar of Boards of Conciliation and Investigation of the proceedings under "The Industrial Disputes Investigation Act, 1907," for the fiscal year ending March 31, 1916. Presented by Hon. Mr. Crothers, January 22, 1917.
Printed for distribution and sessional papers.

37. Twelfth Annual Report of the Commissioners of the Transcontinental Railway, for the year ended March 31, 1916. Presented by Hon. Mr. Cochrane, April 19, 1917.
Printed for distribution and sessional papers.

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38. Report of the Department of the Naval Service, for the fiscal year ending March 31, 1916. Presented by Hon. Mr. Hazen, January 22, 1917.
Printed for distribution and sessional papers.

38a. Supplement to the Sixth Annual Report of the Department of Naval Service, Fisheries Branch,—Contributions to Canadian Biology, being studies from the biological stations of Canada, 1915-1916. Presented by Hon. Mr. Hazen, June 4, 1917.
Printed for distribution and sessional papers.

38c. Lobster Conservation in Canada, by A. P. Knight, M.A.
Printed for distribution and sessional papers.

39. Forty-ninth Annual Report of the Fisheries Branch of the Department of the Naval Service, 1915-16. Presented by Hon. Mr. Hazen, January 22, 1917.
Printed for distribution and sessional papers.

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40. The Report of the Joint Librarians of Parliament. Presented by Hon. Mr. Speaker, January 19, 1917... .. ..*Not printed.*

41. Copies of Orders in Council, as follows:—

P.C. 1917, dated the 15th day of July, 1916, respecting the appointment of a Parliamentary Under Secretary of State for External Affairs during the continuance of the war.

P.C. 2576, dated the 21st day of October, 1916, respecting the appointment of Hugh Clark, Member of the House of Commons for the Electoral District of North Bruce, to the position of Parliamentary Under Secretary for Exernal Affairs, during the continuance of the present war.

P.C. 1720, dated the 15th day of July, 1916, respecting the appointment of a Parliamentary Secretary of the Department of Militia and Defence, during the continuance of the present war.

P.C. 1730, dated the 19th day of July, 1916, respecting the appointment of Fleming Blanchard McCurdy, Member of the House of Commons for the Electoral District of Shelburne and Queens, to the position of Parliamentary Secretary of the Department of Militia and Defence, during the continuance of the present war.

P.C. 2651, dated the 28th day of October, 1916, respecting the establishment of a ministry in London charged with the administration of the overseas forces of Canada, and the direction and control of the expenditures abroad in connection therewith.

P.C. 2656, dated the 31st day of October, 1916, respecting the appointment of Honourable Sir George Halsey Perley, to the position of Minister of Overseas Military Forces from Canada in the United Kingdom. Presented by Sir Robert Borden, January 18, 1917.. .. ..*Printed for sessional papers only.*

42. Papers relating to the Imperial War Conference, 1917. Presented by Sir Robert Borden, January 22, 1917.. .. ..*Printed for sessional papers only.*

42*a*. Copy of a Parliamentary Paper (Cd. 8566), containing extracts from the Minutes of the Proceedings of the Imperial War Conference, 1917, and Papers laid before the Conference. Presented by Sir Robert Borden, June 15, 1917.

Printed for distribution and sessional papers.

43. Copies of Orders in Council, as follows:—

P.C. 64-15-25, dated the 29th June, 1916, authorizing the superannuation of Mr. Silas Blair Kent, a clerk in Sub-division "B" of the First Division, employed as chief fishing bounty officer of the Naval Service Department.

P.C. 3192, dated 30th December, 1916, Regulations governing the payment of Separation Allowance in the Royal Canadian Navy and Royal Naval Canadian Volunteer Reserve.

P.C. 3108, dated 19th September, 1916, Regulations governing payment of "Command Money" to officers on "Special Service," etc., in the Royal Canadian Navy.

P.C. 2942, dated 29th November, 1916, Regulations governing payment of "Hard-lying Money" in the Royal Canadian Navy.

P.C. 2442, dated 11th October, 1916, Amendment to Order in Council P.C. 1334, dated 3rd June, 1916, establishing Rates of Pensions for the Military and Naval Forces of Canada.

P.C. 2130, dated 9th September, 1916, Regulations for enrolment of men in the Royal Canadian Volunteer Reserve for service in the Royal Navy.

P.C. 1939, dated 18th August, 1916, Order made under War Measures Act, 1914, to reduce risk of persons of enemy nationality landing in Canada under guise of neutrals. Presented by Hon. Mr. Hazen, January 22, 1917... .. .. ..*Not printed.*

43*a*. Copy of extract from Order in Council No. P.C. 942, dated 5th April, 1917, with reference to Regulations governing the Payment of Separation Allowance in the Royal Canadian Navy. Presented by Hon. Mr. Hazen, June 11, 1917.. .. ..*Not printed.*

43*b*. Copy of extract from Order in Council No. P.C. 1397, dated 21st May, 1917: Rules and Regulations to apply to persons who are employed in or who are in or in the vicinity of any store, wharf, etc., in or upon which any ammunition, etc., is handled. Presented by Hon. Mr. Hazen, June 14, 1917... .. ..*Not printed.*

CONTENTS OF VOLUME 21—*Continued.*

43*c*. Copy of Extract from Order in Council No. P.C. 1576, dated 11th June, 1917: Regulations instituting the rank of Chief Skipper and Skipper in the Royal Canadian Navy. Presented by Hon. Mr. Hazen, June 20, 1917.. .. .. *Not printed.*

43*d*. Copy of Order in Council, P.C. 69/1774, dated 28th June, 1917, containing Regulations for the Payment of Specialist Allowance to R.N.C.V.R. and R.N.C.V.R. Overseas Division. Presented by Hon. Mr. Hazen, July 9, 1917.. .. .. *Not printed*

43*e*. Copy Extract from Order in Council, P.C. No. 1783, dated 29th June, 1917:—Rules and Regulations governing the issue of Pay, Allowances and Pensions, Department of the Naval Service—Copy Extract from Order in Council, P.C. No. 1871, dated 6th July, 1917; —Amendment to the Regulations for the payment of Separation Allowance to the dependents of those on Active Service under the Naval Service Department. Presented by Sir James Lougheed, July 12, 1917. (Senate)... .. .. *Not printed.*

43*f*. Extract from Order in Council, P.C. 1993 of the 17th July, 1917: Scale of Subsistence Allowances to Officers and men of the Naval Service when travelling on duty.—And also,—Extract from Order in Council, P.C. 1994 of the 17th July, 1917: Scale of Allowances in lieu of lodging, provisions, fuel and light, for Officers and men of the Naval Service. Presented by Hon. Mr. Hazen, August 6, 1917.. .. .. *Not printed.*

43*g*. Extract from Order in Council, P.C. 2105, dated 9th August, 1917: Amendments to regulations for the issue of pay, allowances and pensions to officers, warrant officers and men invalided, etc., from the Naval Service. Presented by Hon. Mr. Hazen, August 27, 1917... .. .. *Not printed.*

43*h*. Extract from Order in Council ("Defence of Canada Order"), P.C. No. 2277, dated the 17th August, 1917:—Amendments respecting Naval Service. The Senate..*Not printed.*

43*i*. Extract from Order in Council, No. P.C. 2433, dated 1st September, 1917:—Regulations *re* Pay and Allowances to Officers and Men after discharge from the Canadian Naval Service. The Senate.. .. .. *Not printed.*

44. Correspondence relating to the withdrawal of the Ross Rifle from the Canadian Army Corps. Presented by Sir Robert Borden, January 22, 1917.
Printed for sessional papers only.

45. Report of the War Purchasing Commission, covering period from its appointment on May 8, 1915, to December 31, 1916. Presented by Hon. Mr. Kemp, January 23, 1917.
Not printed.

46. Copies of Orders in Council respecting the establishment of a National Service Board of Canada, and appointments thereto, under the provisions of the War Measures Act, 1914. Presented by Sir Robert Borden, January 23, 1917.
Printed for sessional papers only.

47. Copy of Agreement between His Majesty the King and The Acadia Coal Company, Ltd., concerning the lease of the Vale Railway. Presented by Hon. Mr. Cochrane, January 23, 1917... .. .. *Not printed.*

48. Copy of Agreement between His Majesty the King and The Quebec and Saguenay Railway Co., The Quebec Railway Light, and Power Co. The Lotbinière and Megantic Railway Co., and The Quebec Railway Light Heat and Power Co., respecting the acquisition by the Government of the said railways. Presented by Hon. Mr. Cochrane, January 23, 1917.. .. .. *Not printed.*

48*a*. Return to an Order of the House, of the 23rd April, 1917, for a copy of all proceedings in the Exchequer Court of Canada, and judgment of Mr. Justice Cassels concerning the reference of the Quebec and Saguenay Railway, the Quebec and Montmorency Railway and the Lotbinière and Megantic Railway. Presented June 21, 1917. Mr. Lemieux.
Not printed.

CONTENTS OF VOLUME 21—*Continued.*

48*b*. Return to an Order of the House, of the 14th May, 1917, for a copy of the judgment delivered by Mr. Justice Cassels on the 24th day of January, 1917, in the matter of fixing the price to be paid by the Government for the Quebec, Montmorency and Charlevoix Railway, the Quebec and Saguenay Railway, and the Lotbinière and Megantic Railway, under the statute of last session, Chapter 22, 6-7 George V. Presented June 27, 1917. Mr. Graham.. .. ..*Not printed.*

49. Statement of Governor General's Warrants issued since the last Session of Parliament on account of 1916-17. Presented by Sir Thomas White, January 25, 1917.
Not printed.

49*a*. Statement of Governor General's Warrants issued since the adjournment of Parliament on February 7, 1917. Presented by Sir Thomas White, April 24, 1917..*Not Printed.*

50. Copy of Amendments to the Radiotelegraph Regulations since the 1st August, 1914. Presented by Hon. Mr. Hazen, January 25, 1917... .. ..*Not printed.*

50*a*. Copy of Amendment to subsection (*d*) of section 104 of the Radiotelegraph Regulations; Operation of ship stations within a Canadian harbour. Presented by Hon. Mr. Hazen, January 29, 1917.. .. .. *Not printed.*

50*b*. Copy of Amendment to Radiotelegraph Regulations issued by the Minister of the Naval Service, under Section 11, Chapter 43, of the Radiotelegraph Act, 3-4 George V. Presented by Hon. Mr. Hazen, April 19, 1917.. .. ..*Not printed.*

51. Statement of Expenditure on account of "Miscellaneous Unforeseen Expenses," from the 1st April, 1916, to the 18th January, 1917, in accordance with the Appropriation Act of 1916. Presented by Sir Thomas White, January 25, 1917... .. ..*Not printed.*

52. Statement of Temporary Loans issued since April 1, 1916, to 18th January, 1917. Presented by Sir Thomas White, January 25, 1917... .. ..*Not printed.*

53. Report and Statement of Receipts and Expenditures of the Ottawa Improvement Commission to March 31, 1916. Presented by Sir Thomas White, January 25, 1917.
Not printed.

54. Statement of the Receipts and Expenditures of the Royal Society of Canada, for the year ended April 30, 1916. Presented by Sir Thomas White, January 25, 1917...*Not printed.*

55. Statement of Receipts and Expenditures of the National Battlefields Commission to 31st March, 1916. Presented by Sir Thomas White, January 25, 1917.. ..*Not printed.*

56. Statement of Superannuation and Retiring Allowances in the Civil Service during the year ending 31st December, 1916, showing name, rank, salary, service allowance and cause of retirement of each person superannuated or retired, also whether vacancy has been filled by promotion, or by appointment, and the salary of any new appointee. Presented by Sir Thomas White, January 25, 1917... .. ..*Not printed.*

57. Statement in pursuance of Section 17 of the Civil Service Insurance Act, for the year ending March 31, 1916. Presented by Sir Thomas White, January 25, 1917.
Not printed.

58. Regulations under "The Destructive Insect and Pest Act," pursuant to Section 9, Chapter 31 of 9-10 Edward VII. Presented by Hon. Mr. Burrell, January 26, 1917.
Not printed.

59. Account of the average number of men employed on the Dominion Police Force during each month of the year 1916, and of their pay and travelling expenses, pursuant to Chapter 92, Section 6, Subsection 2, of the Revised Statutes of Canada. Presented by Hon. Mr. Doherty, January 26, 1917... .. ..*Not printed.*

60. Copy of the evidence taken before the Hon. Sir Charles Davidson, Kt., Commissioner appointed to inquire into the purchase by and on behalf of the Government of the Dominion of Canada, of Arms, Munitions, Implements, Materials, Horses, Supplies, and other things for the purpose of the present war, and as to the expenditures and payments made or agreed to be made therefor; together with the Report of the said Commissioner concerning the sale of Small Arms Ammunition; purchase of Submarines, and Military Cloth (Auburn Woollen Mills Co.). Presented by Hon. Mr. Meighen, January 30, 1917.. .. ..*Not printed.*

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61. Report submitted by the officer in charge of the Canadian Records Office, London, Eng., to The Right Honourable Sir Robert Borden, G.C.M.G., M.P., Prime Minister of Canada, on the work of the Canadian War Records Office since the date of its foundation to the 11th January, 1917. Presented by Sir Robert Borden, January 31, 1917.
Not printed.

62. Annual Return respecting Trade Unions under Chapter 125, R.S.C., 1906. Presented by Hon. Mr. Patenaude, January 31, 1917.. .. ..*Not printed.*

63. A detailed statement of all bonds or securities registered in the Department of the Secretary of State of Canada, since last return (22nd January, 1916) submitted to the Parliament of Canada under Section 32 of Chapter 19, of the Revised Statutes of Canada, 1906. Presented by Hon. Mr. Blondin, January 31, 1917... ..*Not printed.*

64. Return of Orders in Council which have been published in the *Canada Gazette*, between the 1st January, 1916, and the 31st December, 1916, in accordance with the provisions of Section 5 of "The Dominion Lands Survey Act," Chapter 21, 7-8 Edward VII. Presented by Hon. Mr. Roche, February 1, 1917.. .. ..*Not printed.*

65. Return of Orders in Council which have been published in the *Canada Gazette*, between 1st January, 1916, and the 31st December, 1916, in accordance with the provisions of "The Forest Reserves and Park Act," Section 19, of Chapter 10, 1-2 George V. Presented by Hon. Mr. Roche, February 1, 1917.. .. ..*Not printed.*

66. Return of Orders in Council which have been published in the *Canada Gazette*, between the 1st January, 1916, and the 31st December, 1916, in accordance with the provisions of Chapter 47, 2 George V, entitled "The Railway Belt Water Act." Presented by Hon. Mr. Roche, February 1, 1917... .. ..*Not printed.*

67. Return of Orders in Council which have been published in the *Canada Gazette* and in the British Columbia *Gazette*, between 1st January, 1916, and the 31st December, 1916, in accordance with provisions of Subsection (*d*) of Section 38 of the regulations for the survey, administration, disposal and management of Dominion Lands within the 40-mile Railway Belt in the Province of British Columbia. Presented by Hon. Mr. Roche, February 1, 1917.. .. ..*Not printed.*

68. Return showing all lands sold by the Canadian Pacific Railway Company during the year, from the 1st October, 1915, to 30th September, 1916, together with the names of the purchasers, in accordance with the Statutes of Canada, 1886, Chapter 9, Section 8. Presented by Hon. Mr. Roche, February 1, 1917.. .. ..*Not printed.*

69. Return of Orders in Council which have been published in the *Canada Gazette*, between 1st January, 1916, and the 31st December, 1916, in accordance with the provisions of Section 77 of "The Dominion Lands Act," Chapter 20, 7-8 Edward VII. Presented by Hon. Mr. Roche, February 1, 1917.. .. ..*Not printed.*

70. Certified copies of Reports of the Committee of the Privy Council, approved by His Excellency the Governor General on the 29th November, 1916, giving authority for the cancellation on and from the 1st January, 1917, of the agreements between the Government of Canada and the Governments of Manitoba, Saskatchewan and Alberta, respectively, respecting the services of the Royal North West Mounted Police in those provinces. Presented by Sir Robert Borden, February 1, 1917.
Printed for sessional papers only.

70*a*. Return to an Address to His Excellency the Governor General, of the 31st January, 1917, for a copy of all documents, letters, messages, correspondence, etc., respecting the termination of the agreements between the Government of Canada and the Governments of the Provinces of Saskatchewan and Alberta in reference to the Royal North West Mounted Police. Presented June 1, 1917. Mr. McCraney.. .. ..*Not printed.*

71. Return to an Order of the House, of the 20th March, 1916, for a copy of all telegrams, letters and correspondence concerning the appointment of Mr. Alfred Gravel, Harbour Commissioner of Quebec, and concerning all other candidates for the position of Commissioner on the Harbour Board of Quebec, to represent the South Shore. Presented February 2, 1917. Mr. Bourassa... .. ..*Not printed.*

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72. Return to an Address to His Royal Highness the Governor General, of the 2nd February, 1914, for a copy of all Orders in Council, correspondence, petitions, telegrams and other papers or documents bearing date between the years 1885 and 1914 in any way relating to the prohibition of the export of Sockeye Salmon from the Province of British Columbia. Presented February 2, 1917.—*Mr. Sinclair*.. .. ..*Not printed.*

73. Seventh Annual Report of the Commission of Conservation for the fiscal year ending March 31, 1916. Presented by Hon. Mr. Hazen, February 5, 1917.. .. ..*Not printed.*

74. Copy of correspondence between Sir Robert Borden and Sir Wilfrid Laurier respecting proposals for the extension of the term of Parliament, November 3, 1915, to January 3, 1917. Presented by Sir Robert Borden, May 23, 1917.
Printed for sessional papers only.

75. Detailed Statement of Customs Duties and the Refund thereof, under Section 92, Consolidated Revenue Act, for the year ended March 31, 1916. (Senate)... ..*Not printed.*

75*a*. Detailed Statement of all Remissions and Refunds of the Tolls or duties for the fiscal year ending March 31, 1916.—Also,—Supplementary statement of the Remissions and Refunds of Tolls and Duties from the Department of Marine and Fisheries. Presented by Hon. Mr. Patenaude, April 19, 1917.. .. .. *Not printed.*

76. Ordinances of the Yukon Territory, passed by the Yukon Council in 1916. (Senate).
Not printed.

76*a*. Return of Orders in Council passed under the provisions of Section 18, of Chapter 63, Revised Statutes of Canada, "An Act to provide for the Government of the Yukon Territory." Presented by Hon. Mr. Patenaude, April 19, 1917.. .. ..*Not printed.*

76*b* Return of Orders in Council passed in the year 1917, under the provisions of Section 18, of Chapter 63, Revised Statutes of Canada, "An Act to provide for the Government of the Yukon Territory." Presented by Hon. Mr. Sevigny, July 5, 1917.
Not printed.

77. Copy of extract from Order in Council No. P.C. 43/263, dated 27th January, 1917, authorizing Regulations governing the payment of Allowance for the Accountant Officers in the Royal Canadian Navy of Receiving Ships and Depot Ships, in accordance with the provisions of Secton 47, Chapter 43, 9-10 Edward VII. Presented by Hon. Mr. Hazen, February 6, 1917.. .. ..*Not printed.*

78. Return to an Order of the House of the 31st January, 1917, for a copy of all correspondence respecting the appointment of a Commission to investigate the financial and economic condition of Canadian railways, showing the names of the Commissioners, the rate of their remuneration, along with the names of the secretaries and engineers appointed by them, or by the Commission, and the rate of their remuneration. Presented February 6, 1917.—*Sir Wilfrid Laurier*.. .. ..*Not printed.*

79. Return to an Order of the House of the 31st January, 1917, for a copy. of all papers, letters, telegrams and other documents relative to the removal of Mr. H. D. McKenzie as mechanical foreman at Stellarton on the Canadian Government Railways, and the appointment of his successor. Presented February 6, 1917.—*Mr. Macdonald.*
Not printed.

80. Return to an Order of the House of the 31st January, 1917, for a return showing the quantity of freight carried over the Grand Trunk Pacific Railway between Lévis and Moncton since that portion of said railway has been operated by the Canadian Government Railways System. Presented February 6, 1917.—*Mr. Copp*.. .. ..*Not printed.*

81. Return to an Order of the House of the 12th April, 1916, for a Return showing:—1. How many clerks there are in the Interior Department who belong to and are paid from the outside service vote and who work in the inside service? 2. The names of said clerks? 3. Salary paid to each? 4. How long each has been in the service of the Department? 5. If all or any of these clerks have passed any examination. If so, what examination and on what date or dates? Presented February 6, 1917.—*Mr. Turriff*.. ..*Not printed.*

CONTENTS OF VOLUME 21—*Continued.*

82. Return to an Order of the House of the 15th March, 1916, for a copy of all correspondence between the Government and the Provinces, regarding increased co-operation in the promotion of immigration and land settlement, commencing with a letter of the Minister of the Interior to the Provincial Prime Ministers, in November, 1911. Presented February 6, 1917.—*Sir Wilfrid Laurier*... .. ..*Not printed.*

83. Return to an Order of the House of the 27th March, 1916, for a Return showing:—1. The names and salaries of the persons employed in the Immigration Service in the City of Montreal; their respective salaries when appointed and what they receive at the present time? 2. Which of such employees are given travelling or other expenses, and how much has been been paid to each on that account since their respective appointments. Presented February 6, 1917.—*Mr. Lachance*.. .. ..*Not printed.*

84. Return to an Order of the House of the 31st January, 1917, for a return showing the quantities of timber cut, and the sum paid therefor, to date, under the lease or sale of timber made by the Indian Department to Mr. Arthur Webber from lands situated near Ship Harbour Lake, Halifax County, together with the name or names of all surveyors of the timber cut from the said Indian lands under the above-mentioned sale or lease, and copies of all reports made in connection therewith by said surveyors. Presented February 6, 1917.—*Mr. McLean (Halifax)*... .. ..*Not printed.*

85. A copy of the Special Report made by the Royal Commission on Indian Affairs on the Kitsilano Indian Reserve, together with the Order in Council passed on the 28th March, 1916, and all other papers and correspondence relating to the Report. (Senate). *Not printed.*

86. Return to an Address to His Excellency the Governor General, of the 31st January, 1917, for a copy of all correspondence exchanged between the Dominion Government and the Provincial Governments inviting them to a conference on the subject of making provisions for returned soldiers, including a copy of the proceedings of the conference which took place on the 10th of January at Ottawa on the same subject. Presented February 7, 1917.—*Sir Wilfrid Laurier* .. ..*Printed for sessional papers only.*

87. Return to an Order of the House, of the 31st January, 1917, for a copy of all correspondence between any Member of the Government and Sir Thomas Tait referring to his appointment to, and resignation from, the National Service Board. Presented February 7, 1917.—*Mr. Graham*.. .. ..*Printed for sessional papers only.*

87*a*. Return to an Order of the House of the 31st January, 1917, for a copy of all correspondence between Mr. Murray, Secretary of the Manufacturers' Association, and any Member of the Government, or Sir Thomas Tait, as head of the National Service Board, concerning his suggested appointment as Secretary of the National Service Board. Presented June 1, 1917.—*Mr. Graham*.. .. ..*Not printed.*

88. Correspondence between the Prime Minister and the Leader of the Opposition concerning the formation of a Parliamentary National Service Commission. Presented by Sir Robert Borden, February 7, 1917... .. ..*Printed for sessional papers only.*

89. Return to an Order of the House, of the 5th February, 1917, for a copy of all petitions, letters, telegrams, reports and other documents relative to the closing of the Canard and Splitlog Post Office and the opening of Loiselleville Post Office, in the County of Essex, together with a copy of all petitions and documents relative to the establishment of rural mail routes from the Loiselleville Post Office. Presented February 7, 1917.—*Mr. Wilcox*.. .. ..*Not printed.*

90. Report on the Canadian Army Medical Service, by Colonel Herbert A. Bruce, Special Inspector General, Medical Services, Canadian Expeditionary Force, dated at London, England, 20th September, 1916. Presented by Sir Robert Borden, February 7, 1917. *Not printed.*

90*a*. Report on the Canadian Army Medical Service, by a Board of Officers, presided over by Surgeon-General Sir William Babtie, K.C.M.G., C.B., V.C., dated at London, England, December 22, 1916. Presented by Sir Robert Borden, February 7, 1917..*Not printed.*

CONTENTS OF VOLUME 21—*Continued.*

90*b*. Copy of Interim Report of the Surgeon-General G. C. Jones, Director Medical Services. Canadians, in reply to the Report on the Canadian Army Medical Service by Colonel Herbert A. Bruce, Special Inspector-General, Medical Services, Canadian Expeditionary Force, dated London, September 28, 1916. Presented by Sir Edward Kemp, May 31, 1917.. .. ..*Not printed.*

91. Return to an Order of the House, of the 7th February, 1917, for a copy of all letters, telegrams, papers and other documents relative to the closing of the Marine Agency at Pictou last autumn, and as to the re-opening of said agency. Presented April 19, 1917. —*Mr. Macdonald*.. .. ..*Not printed.*

92. Return to an Order of the House of the 5th February, 1917, for a Return showing:—1. The number of horses that have been bought in Canada for war purposes in each of the years 1914, 1915 and 1916, resepctively, (*a*) for the Canadian Army; (*b*) for Britain; and (*c*) for France and our other Allies. 2. The amount paid for the horses in each of the years for the different countries mentioned. Presented April 19, 1917.—*Mr. Edwards*.. .. ..*Not printed.*

93. Return to an Order of the House of the 31st January, 1917, for a Return showing:—1. The names, home addresses and former occupations of all censors, decoders or other employees of the Government in the different cable stations in Nova Scotia during the calendar year 1916. 2. The name of the person who recommended each of the said censors, decoders or employees. 3. What salary was paid to each of said persons for the calendar year 1916. Presented April 19, 1917.—*Mr. Sinclair*.. ..*Not printed.*

94. Copies of General Orders promulgated to the Militia for the period between December 30, 1915, and February 8, 1917. Presented by Sir Edward Kemp, April 19, 1917.
Not printed.

95. Return to an Order of the House of the 11th March, 1915, for a copy of all charges, correspondence, letters, telegrams and other documents relative to the dismissal of Frank Dunlop, of Graves Point, at Sydney Mines, in the riding of North Cape Breton and Victoria, N.S., and the expenses of such investigation in detail. Presented April 19, 1917.—*Mr. McKenzie*.. .. ..*Not printed.*

96. Return to an Order of the House of the 3rd April, 1916, for a Return showing:—1. The names of the staff in the office of the High Commissioner for Canada in London? 2. Whether any of these officials are natives of Canada. If so which ones? 3. Whether it is true, as alleged, that Canada is the only British Dominion which employs none of its natives in its High Commissioner's Office. Presented April 19, 1917.—*Mr. Proulx.*
Not printed.

97. Return to an Address to His Royal Highness the Governor General, of the 22nd February, 1915, for a copy of all Orders in Council, memoranda, correspondence or other documents in the possession of the Government, or any Department thereof, relating to the trade in dried fish and wines between Portugal and Canada. Presented April 19, 1917.—*Mr. Sinclair*.. .. ..*Not printed.*

98. Return to an Order of the House of the 31st January, 1917, for a tabulated statement showing the number of divorces granted by the Parliament of Canada since 1867. Presented April 19, 1917.—*Mr. Lemieux*.. .. ..*Not printed.*

99. Return to an Order of the House of the 3rd February, 1916, for a copy of all letters, telegrams and other documents, including tenders, relating to the mail contract from Tatamagouche to New Annan and Tatamagouche Mountain, in the County of Colchester. Presented April 19, 1917.—*Mr. Macdonald*.. .. ..*Not printed.*

100. Copy of new Rule in substitution of Rule 236 of the General Rules and Orders now in force regulating the practice and procedure in the Exchequer Court of Canada, made on the 16th day of February, 1917. Presented by Hon. Mr. Patenaude, April 19, 1917.
Not printed.

CONTENTS OF VOLUME 21—*Continued.*

100a. Copy of Rule 200 of the General Rules and Orders now in force regulating the practice and procedure in the Exchequer Court of Canada; also, Copy of General Order respecting fees and costs in the Exchequer Court in the exercise of its jurisdicton as a Court of Admiralty. Presented by Hon. Mr. Patenaude, May 3, 1917.....*Not printed.*

101. Return to an Order of the House of the 5th February, 1917, for a return showing a list of all persons employed during the year 1916 in the round-house of the Canadian Government Railways at Pirate Harbour, N.S., as brakemen, telegraphers, cleaners and labourers, showing the dates of their appointments and length of time employed respectively, and also the monthly rate of wages paid to each of said employees. Presented April 19, 1917.—*Mr. Sinclair*.. .. ..*Not printed.*

102. Return to an Order of the House of the 31st January, 1917, for a copy of all letters, papers, telegrams and other documents relative to the application for, and the granting of, a Conciliation Board to the employees of the Acadia Coal Company in the spring of 1916, the proceedings of said Board, and all other papers in relation to the same. Presented April 19, 1917.—*Mr. Macdonald*.. .. ..*Not printed.*

103. Return to an Order of the House of the 31st January, 1917, for a copy of all correspondence, telegrams and documents of all kinds exchanged between any person or persons and the Department of Labour or any other Department of the Government relating to the labour trouble at Thetford Mines, P.Q., and also copies of all correspondence exchanged between the different Departments of the Government respecting the same question. Presented April 19, 1917.—*Mr. Verville*.. .. ..*Not printed.*

104. Return to an Order of the House of the 31st January, 1917, for a copy of all letters, papers, telegrams and other documents relative to the application for, and the refusal to grant a Conciliation Board as petitioned for under the Industrial Disputes Investigation Act by the employees of the Canadian Government Railway at Pictou, who were members of the Longshoremen's Union at Pictou during the year 1916. Presented April 19, 1917.—*Mr. Macdonald*.. .. ..*Not printed.*

105. Return to an Order of the House of the 7th February, 1917, for a copy of the contract between the Government and the P. Lyall & Sons Construction Company for the reconstruction of the Parliament Building. Presented April 20, 1917.—*Mr. Murphy.*
Printed for Sessional Papers only.

106. Copy of Order in Council P.C. 1062, dated 16th April, 1917, ordering that wheat, wheat flour and semolina be transferred to the list of goods which may be imported into Canada free of duty of customs. Presented by Sir Thomas White, April 20, 1917.
Printed for Sessional Papers only.

107. Return to an Order of the House of the 19th April, 1917, for a return showing:—1. Whether the Government is aware as to whether there are cases in the Military Service in which men after enlistment have been given leave on harvesting furlough, and during such leave have been injured by accident, and who have in consequence of such accident incurred hospital bills, and who having been treated in hospital have returned to military duty and been discharged on account of injuries so received. 2. If so, whether claims have been made for hospital care and treatment. 3. If such claims have been recognized by the Government. 4. If not, why not. 5. If so, what action has been taken in connection therewith. 6. Whether in such cases the enlisted person is not entitled to pay up to time of discharge, and also the payment of his hospital account. Presented April 20, 1917.—*Mr. MacNutt*.. .. ..*Not printed.*

108. Copy of a communication from the Deputy Minister of Militia and Defence, relative to the total value of the Oliver equipment, so-called, supplied the Canadian soldiers who have crossed to England since the commencement of the present war. Presented by Sir Edward Kemp, April 20, 1917.. .. ..*Not printed.*

109. Return to an Order of the House of the 19th April, 1917, for a return showing:—1. The names of the Members of Parliament who now belong, or who did belong to the Overseas

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Forces or the Militia Forces of Canada since the present war was declared. 2. Whether these Members or any of them were, or are in receipt of pay from the Militia Department and in receipt of their indemnity as Members at the same time. 3. Whether the wives of these Members, or any of them were, or are in receipt of separation allowance. Presented April 20, 1917.—*Mr. Hughes (Kings, P.E.I.)*.. .. ..*Not printed.*

109a. Supplementary return to an Order of the House of the 19th April, 1917, for a return showing:—1. The names of the Members of Parliament who now belong, or who did belong to the Overseas Forces or the Militia Forces of Canada since the present war was declared. 2. Whether these Members, or any of them were, or are in receipt of pay from the Militia Department and in receipt of their indemnity as Members at the same time. 3. Whether the wives of these Members, or any of them were, or are in receipt of separation allowance. Presented April 24, 1917.—*Mr. Hughes (Kings, P.E.I.)*. . . .*Not printed.*

109b. Return to an Order of the House of the 25th April, 1917, for a return showing:—1. How many Members of the House of Commons are serving or have served in the Canadian Army. 2. The names of each of said Members, the date of appointment, and rank. 3. The names of those Members who have resigned or have withdrawn from military service and the date of withdrawal or resignation. 4. How much has been paid to each for military salary, expenses and separation allowance to wife or relatives, respectively. Presented May 31, 1917.—*Mr. Turriff*.. .. ..*Not printed.*

109c. Corrected copy of a return to an Order of the House of the 25th April, 1917, for a return showing:—1. How many Members of the House of Commons are serving or have served in the Canadian Army. 2. The names of each of said Members, the date of appointment, and rank. 3. The names of those Members who have resigned or have withdrawn from military service and the date of withdrawal or resignation. 4. How much has been paid to each for military service, expenses and separation allowance to wife or relatives, respectively. Presented June 14, 1917.—*Mr. Turriff*.. .. ..*Not printed.*

110. Return to an Order of the House of the 19th April, 1917, for a return showing:—1. What amounts have been given to the Canadian Patriotic Fund to December 31, 1916, and what amounts have been promised for 1917, by the different counties, towns and cities in each of the different provinces. 2. The names of the different counties, towns and cities, and the respective amounts subscribed and promised by each. 3. What counties, cities and towns in each province, if any, have not contributed any amount to the said fund up to the present time. Presented April 24, 1917.—*Mr. Edwards*.. ..*Not printed.*

110a. Return to an Order of the House of the 19th April, 1917, for a return showing:—1. How much money has been subscribed and voted to the Canadian Patriotic Fund by each of the different provinces to December 31, 1916. 2. How much money has been paid to the Canadian Patriotic Fund by each of the different provinces during the same time. 3. How much money has been promised by county, township, city or other grants by each province for the year 1917. 4. How many persons in each province have received assistance from the Canadian Patriotic Fund to December 31, 1916. 5. The total amount so expended in each province. Presented April 24, 1917.—*Mr. Edwards*.. ..*Not printed.*

111. Copy of Order in Council P.C. 802, dated 23rd March, 1917, in respect to taking over of the Ross Rifle Factory by the Government of Canada. Presented by Sir Edward Kemp, April 24, 1917.. .. ..*Not printed.*

112. Return to an Order of the House of the 31st January, 1917, for a copy of all documents, letters, telegrams and other correspondence in the Department of the Interior, relating to grazing leases numbers 2785, 2803, 2843, 3701, 3998, 4603, 5566, 6220 and 6221. Presented April 25, 1917.—*Mr. Steele*.. .. ..*Not printed.*

113. Memorandum from the Superintendent of Immigration respecting the advertising by the Canadian Government in United States newspapers for farm hands to work in Canada; together with a copy of the advertisements and instructions concerning the same. Presented by Hon. Mr. Roche, April 25, 1917.. .. ..*Not printed.*

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114. Copies of Orders in Council:—

P.C. 341, dated the 7th day of February, 1917, respecting the exportation of newsprint paper in sheets or rolls by license only under regulations by the Minister of Customs.

P.C. 445, dated the 17th day of February, 1917, containing orders and regulations respecting the price, sale, control, distribution, transport, etc., of newsprint paper in sheets or rolls.

P.C. 1059, dated the 16th day of April, 1917, empowering the Minister of Customs to fix the quantity and price of newsprint paper furnished or to be furnished to the publishers in Canada by the manufacturers; and controlling the distribution and delivery of the same.

P.C. 1060, dated the 16th day of April, appointing R. A. Pringle a commissioner to conduct an inquiry into and concerning the manufacture, sale, price and supply of newsprint paper within the Dominion of Canada. Presented by Sir Thomas White, April 26, 1917.. .. .. .

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and all other persons, concerning either the construction or repairing or purchase of the wharves at the following places: Ile Perrot Sud, the Church in the Village of Ile Perrot, the Village of Vaudreuil, Pointe Cavagnal, Hudson, Rigaud, Graham, Pointe Fortune, and Ile Perrot Nord. Also, a copy of all specifications and reports already brought down at my request in relation to the documents prior to and since 1904, and a statement of the amounts that have been paid for such construction or repairs, and to whom they were paid. Presented April 30, 1917.—*Mr. Boyer*.. .. ..*Not printed.*

122a. Return to an Order of the House of the 16th February, 1916, for a copy of all letters, petitions, correspondence, telegrams and reports, exchanged between the Government, the engineers residing in the district, and all other persons, concerning the construction and repairing done to the wharves mentioned below, since 1904, and of all data and reports already produced at my request and relating to documents prior to 1904; also the amounts of money paid for such construction and repairing, and to whom paid:—The wharf at Ile Perrot North, South, and at the Church; of the Village of Vaudreuil; of Pointe Cavagnal; of Hudson; of Graham; of Rigaud, and of Pointe Fortune. Presented April 30, 1917.—*Mr. Boyer*.. .. ..*Not printed.*

122b. Return to an Order of the House of the 30th April, 1917, for a copy of all letters, petitions, correspondence, telegrams and reports exchanged between the Government, the resident engineer and all other persons, concerning the construction and repairing done to the wharves at Ile Perrot North, South and at the Church; Village of Vaudreuil, Pointe Cavagnal, Hudson, Graham, Rigaud and Point Fortune since 1904. Also, a copy of all data and reports regarding above already produced at my request relating to documents prior to 1904, showing the amounts of money paid for such construction and repairing, and to whom paid. And also, return to an Order of the House of the 30th April, 1917, for a copy of all letters, petitions, correspondence and telegrams exchanged between the Government, the district engineer, and any other persons concerning either the construction, repairing or purchase of the wharves at Ile Perrot South, the Church in the Village of Ile Perrot, Village of Vaudreuil, Pointe Cavagnal, Hudson, Rigaud, Graham, Pointe Fortune and Ile Perrot North, since 1904. Also a copy of all specifications and reports already brought down at my request in relation to above prior to, and since 1904, giving a statement of the amounts that have been paid for such construction or repairs, showing to whom they were paid. Presented August 13, 1917.—*Mr. Boyer.*

Not printed.

123. Return to an Order of the House of the 19th April, 1916, for a copy of all letters, petitions, correspondence and telegrams exchanged between the Government, its resident engineer, and all other prsons, concerning the dredging work done at the following places:—Ste. Anne de Bellevue, Pointe Fortune, Ottawa River Channel between Ile au Foin and Ile à Paquin, Graham channel, Rigaud channel, Hudson Heights channel, Hudson, Como, Pointe Cavagnal, channel at Vaudreuil Village, Dorion Bay channel, Ile Perrot Church, Ile Perrot Sud Wharf, and Ile Perrot Nord Wharf. Also, a statement of the amounts paid to different persons, companies, etc., for such work, the dates, etc., and a copy of the estimates already brought down at my request, the whole since 1904. Presented April 30, 1917.—*Mr. Boyer*.. .. ..*Not printed.*

123a. Return to an Order of the House of the 16th February, 1916, for a copy of all letters, petitions, correspondence, telegrams and reports exchanged between the Government, the resident engineer of the district, and all other persons, concerning the dredging work done at the places below named, and the amount of money paid to divers, persons companies, etc., for such work, as well as the statements already presented at any request, the whole since 1904:—At the wharf of Ile Perrot, North, South and at the Church; in Dorion Bay channel; at Vaudreuil Village channel; at Pointe Cavagnal; at Como; at Hudson; at Hudson Heights channel; at Graham channel; in the Rigaud River channel; in the Ottawa river; Ile aux Poires channel; at Pointe Fortune, and at Ste-Anne de Bellevue channel. Presented April 30, 1917.—*Mr. Boyer*.. .. .. ..*Not printed.*

124. Return to an Order of the House of the 3rd May, 1916, for a copy of all letters, telegrams, bills, vouchers and memoranda in connection with the repairs to the wharf at Upper Prospect, Halifax County, N.S., in 1915. Presented April 30, 1917.—*Mr. McLean (Halifax)*.. .. ..*Not printed.*

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125. Return to an Order of the House of the 3rd May, 1916, for a copy of all letters, telegrams, bills, vouchers and memoranda in connection with the repairs to the wharf at Shad Bay, Halifax County, N.S., in 1915. Presented April 30, 1917.—*Mr. McLean (Halifax)*.. .. .. .

CONTENTS OF VOLUME 21—*Continued.*

136. Return to an Order of the House of the 23rd April, 1917, for a return showing:—1. The names, former post office addresses, occupations and salaries paid to the censors and decoders in the employ of the Government at Hazel Hill and Canso during the year 1916. 2. How much has been expended in connection with this service at Canso and Hazel Hill since the first of August, 1914, up to the present date. 3. How much has been expended in connection with the said service in embracing all the stations in the province of Nova Scotia from August 1, 1914, up to the present date. Presented May 2, 1917.—*Mr. Sinclair*.. .. ..*Not printed.*

137. Return to an Order of the House of the 23rd April, 1917, for a copy of all contracts and agreements between Sir Charles Ross, his successors or assigns, and His Majesty the King, represented by the Minister of Militia and Defence, since and including the agreement between them dated the 27th day of March, A.D., 1902. Presented May 2, 1917. *Mr. Northrup*.. .. ..*Printed for Sessional Papers only.*

138. Return to an Order of the House of the 23rd April, 1917, for a return showing:—1. How many permanent civil servants or officials were in the employ of the Department of Militia and Defence on the 10th day of October, 1911, and how many on the 31st of March, 1917. 2. How many temporary civil servants and employees of all kinds were in the employ of the said Department on the 10th day of October, 1911, and how many on the 31st of March, 1917. 3. How many permanent civil servants or officials were appointed by said Department since the 1st of August, 1914. 4. How many temporary civil servants and employees were employed by said Department since August 1, 1914. 5. What was the gross amount paid by said Department for salaries and expenses to both permanent and temporary civil servants and employees for the fiscal year ending March 31, 1914. 6. What was the gross amount paid by said Department for salaries and expenses of all permanent and temporary civil servants and employees for the fiscal year ending March 31, 1917. 7. How many civil servants were appointed by said Department since October 10, 1911, under the provisions of Section 21 of the Civil Service Act. Presented May 2, 1917.—*Mr. Macdonald*.. .. ..*Not printed.*

138*a*. Return to an Order of the House of the 2nd May, 1917, for a return showing:—1. How many permanent civil servants or officials were in the employ of the Department of Naval Affairs on the 10th day of October, 1911, and how many on the 31st of March, 1917. 2. How many temporary civil servants and employees of all kinds were in the employ of the said Department on the 10th day of October, 1911, and how many on the 31st of March, 1917. 3. How many permanent civil servants or officials were appointed by said Department since the 1st of August, 1914. 4. How many temporary civil servants and employees were employed by said Department since August 1, 1914. 5. What was the gross amount paid by said Department for salaries and expenses to both permanent and temporary civil servants and employees for the fiscal year ending March 31, 1911. 6. What was the gross amount paid by said Department for salaries and expenses of all permanent and temporary civil servants and employees for the fiscal year ending March 31, 1917. 7. How many civil servants were appointed by said Department since October 10, 1911, under the provisions of Section 21 of the Civil Service Act. Presented May 16, 1917.—*Mr. Chisholm*.. .. ..*Not printed.*

138*b*. Return to an Order of the House of the 2nd May, 1917, for a return showing:—1. How many permanent civil servants or officials were in the employ of the Department of Marine and Fisheries on the 10th day of October, 1911, and how many on the 31st day of March, 1917. 2. How many temporary civil servants and employees of all kinds were in the employ of the said Department on the 10th day of October, 1911, and how many on the 31st of March, 1917. 3. How many permanent civil servants or officials were appointed by said Department since the 1st of August, 1914. 4. How many temporary civil servants and employees were employed by said Department since August 1, 1914, 5. What was the gross amount paid by said Department for salaries and expenses to both permanent and temporary civil servants and employees for the fiscal year ending March 31, 1911. 6. What was the gross amount paid by said Department for salaries and expenses of all

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permanent and temporary civil servants and employees for the fiscal year ending March 31, 1917. 7. How many civil servants were appointed by said Department since October 10, 1911, under the provisions of Section 21 of the Civil Service Act. Presented May 31, 1917.—*Mr. Sinclair*.. .. .. .

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by said Department since 1st of August, 1914. 4. How many temporary civil servants and employees were employed by said Department since August 1, 1914, 5. What was the gross amount paid by said Department for salaries and expenses to both permanent and temporary civil servants and employees for the fiscal year ending March 31, 1914. 6. What was the gross amount paid by said Department for salaries and expenses of all permanent and temporary civil servants and employees for the fiscal year ending March 31, 1917. 7. How many civil servants were appointed by said Department since October 10, 1911, under the provisions of Section 21 of the Civil Service Act. Presented by Hon. Mr. Roche, July 10, 1917.—*Mr. Kyte*.. .. ..*Not printed.*

138*g*. Return to an Order of the House of the 23rd April, 1917, for a return showing:—1. How many permanent civil servants or officials were in the employ of the Department of Agriculture on the 10th day of October, 1911, and how many on the 31st day of March, 1917. 2. How many temporary civil servants and employees of all kinds were in the employ of the said Department on the 10th day of October, 1911, and how many on the 31st of March, 1917. 3. How many permanent civil servants or officials were appointed by said Department since the 1st of August, 1914. 4. How many temporary civil servants and employees were employed by said Department since August 1, 1914, 5. What was the gross amount paid by said Department for salaries and expenses to both permanent and temporary civil servants and employees for the fiscal year ending March 31, 1914. 6. What was the gross amount paid by said Department for salaries and expenses of all permanent and temporary civil servants and employees for the fiscal year ending March 31, 1917. 7. How many civil servants were appointed by said Department since October 10, 1911, under the provisions of Section 21 of the Civil Service Act. Presented August 15, 1917.—*Mr. Hughes (P.E.I.)*.. .. ..*Not printed.*

138*h*. Return to an Order of the House of the 2nd May, 1917, for a return showing:—1. How many permanent civil servants or officials were in the employ of the Department of State and Mines on the 10th day of October, 1911, and how many on the 31st of March, 1917. 2. How many temporary civil servants and employees of all kinds were in the employ of the said Department on the 10th day of October, 1911, and how many on the 31st of March, 1917. 3. How many permanent civil servants or officials were appointed by said Department since the 1st of August, 1914. 4. How many temporary civil servants and employees were employed by said Department since August 1, 1914, 5. What was the gross amount paid by said Department for salaries and expenses to both permanent and temporary civil servants and employees for the fiscal year ending March 31, 1911. 6. What was the gross amount paid by said Department for salaries and expenses of all permanent and temporary civil servants and employees for the fiscal year ending March 31, 1917. 7. How many civil servants were appointed by said Department since October 10, 1911, under the provisions of Section 21 of the Civil Service Act. Presented August 21, 1917.—*Mr. McKenzie*.. .. ..*Not printed.*

139. Return to an address to His Excellency the Governor General of the 23rd April, 1917, for a copy of the Order in Council and all other papers in connection with the awarding of the contract to J. C. Shields and others, or to the Inland Express Company for carrying the mails from Ashcroft to Fort George, B.C. Presented May 2, 1917.—*Mr. Turriff*.. .. ..*Not printed.*

140. Return to an Address to His Excellency the Governor General of the 31st January, 1917, for a copy of all correspondence exchanged with the Governement of the Province of Manitoba concerning a statute passed by the Legislature of Manitoba at its last session, entitled, "An Act to amend the Jury Act"; together with copies of all Orders in Council respecting same. Presented May 3, 1917.—*Sir Wilfrid Laurier*.. *Not printed.*

141. Return to an Order of the House of the 7th February, 1917, for a return showing:—1. The number of interned aliens, and nationality of each, employed on public works since the 4th August, 1914. 2. The number employed in industrial work in the provinces of Canada, and the nationality of each, since the 1st of August, 1914. 3. The number so employed at the present time. Presented May 3, 1917.—*Mr. Kyte*.. .. .. ..*Not printed.*

CONTENTS OF VOLUME 21—*Continued.*

142. Return to an Order of the House of the 2nd May, 1917, for a copy of the report of the Royal Commission appointed by Order in Council, 20th September, 1916, to inquire into and report upon the conditions in regard to the delivery of cargoes of coal to coasting vessels in the Maritime Provinces. Presented May 7, 1917.—*Mr. Hughes (Kings, P.E.I.)*.. .. ..*Not printed.*

143. Return to an Order of the House of the 31st January, 1917, for a return showing:—1. How many applicants for enlistment in the Canadian Overseas Forces have been rejected on account of being physically unfit. 2. How many have been discharged after enlistment for the same reason. Presented May 7, 1917.—*Mr. Steele*.. ..*Not printed.*

143*a*. Return to an Order of the House of the 30th April, 1917, for a return showing:—1. How many Americans have enrolled in Canadian Regiments since the commencement of the war. 2. How many natives of the British Isles are so enrolled in Canada since the 1st of August, 1914. Presented July 31, 1917.—*Mr. Boulay*.. .. ..*Not printed.*

143*b*. Return to an Order of the House of the 31st January, 1917, for a return showing:—1. How many men have enlisted in Canada for overseas service. 2. How many of these have been subsequently discharged as unfit. 3. How many of these were discharged in Canada, and how many overseas. Presented May 7, 1917.—*Mr. Graham*..*Not printed.*

143*c*. Return to an Order of the House of the 14th May, 1917, for a return showing:—1. Whether the Minister of Militia or any of the authorities of the Militia Department has official statistics as to the recruiting of soldiers in Canada for overseas service. 2. If so, what the correct figures are of enlistments in the different overseas regiments raised since August, 1914, to date (*a*) Canadian speaking the French language; (*b*) Canadians speaking the English language and born in Canada; (*c*) British subjects by birth born outside of Canada; (*d*) British subjects by naturalization; (*c*) British subjects by birth born outside of Canada; (*d*) British subjects by naturalization; (*e*) French Canadian soldiers in regiments commanded by officers speaking the English language raised in the province of Quebec; and (*f*) French Canadian soldiers in battalions raised in the other provinces of Canada. Presented June 14, 1917.—*Mr. Lanctôt*.. .. ..*Not printed.*

143*d*. Copy of Census Statistics showing Summary of Strength of all Units of the Canadian Expeditionary Forces in England, period 14th May, 1917, together with statement showing number of Canadian troops in France, England, in the Near East, St. Lucia and in Canada, June, 1917. Presented by Sir Edward Kemp, June 15, 1917.. ..*Not printed.*

144. P.C. 2314, dated 7th October, 1916, appointing a Special Seed Commissioner and three assistants, with authority to purchase seed wheat to fill requisitions for seed from municipal governing bodies in districts that have suffered crop failure due to the prevalence of rust and frost. Also, P.C. 3073, dated 14th December, 1916, authorizing the Special Seed Commission to purchase seed oats and seed barley to fill requisitions for seed from municipal governing bodies and farmers' organizations in districts where there is no supply. Presented by Hon. Mr. Burrell, May 8, 1917.. .. .. ..*Not printed.*

145. Return to an Order of the House of the 1st February, 1917, for a copy of all communications, reports and documents concerning the alleged treatment of Thos. Kelly, a prisoner in the Stony Mountain Penitentiary. Presented May 9, 1917.—*Mr. Buchanan.*
Not printed.

146. Copy of Order in Council, P.C. 1183, dated 28th April, 1917, authorizing the granting, at the request of His Majesty's Government in England, of a further 300 miles of rails for use in France in connection with the war. Presented by Hon. Mr. Meighen, May 10, 1917.. .. ..*Not printed.*

146*a*. Return to an Order of the House of the 13th June, 1917, for a return showing:—1. Between what points on the Canadian Northern Railway Line west of Edmonton the rails are to be taken up to be placed on the Grand Trunk Pacific Line. 2. Between what points on the Grand Trunk Pacific Line west of Edmonton the rails of the Grand Trunk are to be replaced by rails of the Canadian Northern Railway. Presented June 14, 1917.—*Mr. Oliver*.. .. ..*Not printed.*

CONTENTS OF VOLUME 21—*Continued.*

146*b*. Tabulated statement showing list of points on the Eastern Division of the National Transcontinental Railway from which rails were lifted for shipment overseas to France, mileage lifted at each point and replaced with rails from Intercolonial Railway (together with a map accompanying same). Presented by Hon. Mr. Cochrane, June 21, 1917.. .. ..*Not printed.*

147. Return called for by Section 88, of Chapter 62, Revised Statutes of Canada, requiring that the Minister of the Interior shall lay before Parliament, each year, a return of liquor brought from any place out of Canada into the Territories by special permission in writing of the Commissioner of the Northwest Territories, for the year ending 31st December, 1916. Presented by Hon. Mr. Roche, May 11, 1917.. .. ..*Not printed.*

148. Return to an Address to His Excellency the Governor General of the 30th April, 1917, for a copy of the application for Arbitration Boards made to the Labour Department by the Provincial Workman's Association or its officers and the United Mines Workmen of Nova Scotia or its officers. Also a copy of all letters, copies of letters and other documents relating to this matter, along with all letters, papers, other documents and Orders in Council relative to the appointment of a Commission to investigate labour and other conditions in the County of Cape Breton. Presented May 11, 1917.—*Mr. Kyte*.. .. ..*Not printed.*

149. Return to an Order of the House of the 2nd May, 1917, for a copy of all letters, copies of letters, telegrams, reports and all other documents relative to the purchase of the two vessels, *A. J. McKee* and *T. J. Drummonds*, by the Railway Department under the Order in Council dated April 17, 1917. Presented May 14, 1917.—*Mr. Macdonald.*
Not printed.

150. Return to an Order of the House of the 31st January, 1917, for a copy of all correspondence, telegrams, memoranda, etc., by and with the Department of Railways in connection with the naming of stations on the Halifax and Eastern Railway. Presented May 14, 1917.—*Mr. Maclean (Halifax)*.. .. ..*Not printed.*

151. Return to an Order of the House of the 23rd April, 1917, for a copy of all statements, reports, evidence, letters and other papers and documents in the possession of the Department of Railways and Canals relating to a claim for a horse belonging to one Dan McFarlane, injured at Brinley Brook, N.S., by the Canadian Government Railway. Presented May 15, 1917.—*Mr. Sinclair*.. .. ..*Not printed.*

152. Return to an Order of the House of the 25th April, 1917, for a copy of all documents, papers, correspondence and reports concerning the suspension of Polydore Lebel, engineer on the Intercolonial Railway at Rivière du Loup, as a result of a wreck in the year 1916. Presented May 15, 1917.—*Mr. Lapointe (Kamouraska)*.. .. .. ..*Not printed.*

153. Return to an Order of the House, of the 31st January, 1917, for a copy of all letters, telegrams and other documents relative to the removal of Mr. Spenny as Trackmaster on the Short Line, so-called, of the Canadian Government Railway, and to the appointment of Henry Gray as his successor. Presented May 15, 1917.—*Mr. Macdonald.*
Not printed.

154. Return to an Address to His Royal Highness the Governor General, of the 7th February, 1916, for a copy of all papers in connection with the appointment of Léon Roy as interpreter in the Department of the Interior; and also a copy of the Order in Council, documents and correspondence relating to his dismissal. Presented May 16, 1917.—*Sir Wilfrid Laurier*.. .. ..*Not printed.*

155. Return to an Order of the House, of the 30th April, 1917, for a copy of all letters, papers, telegrams and other documents relative to the establishment of the Canadian Government *Railway Employees Magazine*, showing the circulation thereof, the cost of production, receipts, and the persons employed in connection therewith, giving a statement of the amount received by said persons from the Railway in any capacity. Presented May 21, 1917.—*Mr. Macdonald*.. .. ..*Not printed.*

CONTENTS OF VOLUME 21—*Continued.*

156. Return to an Order of the House, of the 22nd March, 1916, for a Return showing:—1. The number of conductors, brakemen, drivers and firemen, respectively, who were on duty on the Canadian Government Railways between Moncton and Campbellton during the month of February, 1916. 2. The number of hours each of the above mentioned trainmen and enginemen were on duty each trip between said points during said month of February, 1916. Presented May 21, 1917.—*Mr. Copp*.. .. ..*Not printed.*

157. Report of Exchequer Court proceedings under Section 49A of the Indian Act, in respect to the removal of the Indians from Sydney Reserve, Nova Scotia. Presented by Hon. Mr. Roche, May 22, 1917.. .. ..*Not printed.*

158. Report of the work of the Military Hospitals Commission from its inception to the present date. Presented by Sir Robert Borden, May 23, 1917. .. ..*Not printed.*

159. Copy of correspondence between Members of the Government and the Canadian Manufacturers Association respecting the purchase of supplies for the Canadian Expeditionary Forces in England and at the Front. Presented by Sir Robert Borden, May 23, 1917.. .. ..*Not printed.*

160. Return to an Order of the House, of the 14th May, 1917, for a copy of the correspondence between the Prime Minister and the ex-Minister of Militia and Defence, which led to the latter's resignation or dismissal from the Government. Presented by Sir Robert Borden, May 23, 1917.—*Mr. Hughes (King's, P.E.I.)*.. .. ..*Not printed.*

161. Return to an humble Address of the Senate to His Excellency the Governor General, dated the 26th day of January, 1917, for a statement showing the date and object of all commissions instituted by the Government of the day, since its accession to power in 1911, up to the present date; the number of days during which each of these commissions sat, giving the names of the individuals who formed part of such commissions, and what was the cost of each to the country. (*Senate.*).. .. ..*Not printed.*

161*a*. Part Return to an humble Address of the Senate, dated the 7th day of February, 1917, to His Excellency the Governor General, for:—A statement showing the date, the object and the personnel of all commissions instituted by the late Government from its accession to power in 1896, up to the accession to power of the present Government in 1911, the number of days during which each of these commissions set, and what was the cost of each to the country. (*Senate.*).. .. ..*Not printed.*

162. Order in Council P.C. 1433, dated 24th May, 1917, containing regulations concerning the departure out of Canada of male persons who are liable to or capable of national service of a military or other character. Presented by Hon. Mr. Roche, May 29, 1917. *Not printed.*

163. Return to an Address to His Excellency the Governor General, of the 23rd May, 1917, for a copy of the Order in Council, if any, providing that preference in appointments to the Civil Service should be given to returned soldiers. Presented May 29, 1917.—*Mr. Boulay*.. .. ..*Not printed.*

164. Return to an Order of the House, of the 3rd February, 1917, for a copy of all reports findings, evidence, memoranda, etc., in connection with the inquiry into the damages sustained by H.M.C.S. *Grilse* en route from Halifax to Bermuda. Presented May 30, 1917.—*Mr. Maclean (Halifax.)*.. .. ..*Not printed.*

165. Return to an Order of the House, of the 14th May, 1917, for a copy of all letters, petitions, correspondence, telegrams and reports in any way referring to the dismissal or retirement of D. McDermid, Superintendent of Fish Hatchery at East Margaree, and the appointment of his successor. Presented May 30, 1917.—*Mr. Chisholm.* *Not printed.*

166. Return to an Order of the House, of the 25th April, 1917, for a copy of all letters, telegrams, reports and other papers and documents relative to the application of Willis Keizer of Hall's Harbour, King's County, N.S., for a license to operate a fishing weir at Square Cove, King's County, N.S. Presented May 30, 1917.—*Mr. Maclean (Halifax.)* *Not printed.*

CONTENTS OF VOLUME 21—*Continued.*

167. Return to an Address to His Excellency the Governor General, of the 23rd April, 1917, for a copy of all correspondence, memoranda, Orders in Council, etc., in reference to the dismissal of Moses H. Nickerson, as Inspector of Life-saving Stations in Nova Scotia Presented May 30, 1917.—*Mr. Maclean (Halifax)*.. .. ..*Not printed.*

168. Copies of Pension Regulations with amendments and as amended to February 28, 1917, with copies of Orders in Council relating thereto. Presented by Sir Thomas White, May 30, 1917.. .. ..*Printed for sessional papers only.*

168*a*. Copy of Order in Council, P.C. 277, dated 30th January, 1917, regarding pensions of officers or their dependants in respect of the exchange of officers between the Government of Canada and the Imperial Government. Presented by Sir Edward Kemp, August 20, 1917.. .. ..*Not printed.*

169. Return to an Order of the House, of the 14th May, 1917, for a copy of all letters, correspondence, petitions, telegrams and reports between the Minister of Marine and Fisheries and any person or persons in any way referring to the removal of the salmon nets on that portion of the coast of Inverness extending east and west from the mouth of the Margaree River. Presented May 31, 1917.—*Mr. Chisholm*.. .. ..*Not printed.*

170. Return to an Order of the House, of the 2nd May, 1917, for a copy of the report of the Commission appointed to investigate the condition of the Military Hospital at Halfax, with a copy of the evidence taken by said Commission at Halifax and all other documents in the possession of the Department of Militia and Defence in connection with such investigation. Presented May 31, 1917.—*Mr. Sinclair*.. .. .. ..*Not printed.*

171. Return to an Order of the House, of the 7th May, 1917, for a return showing the amount paid or spent by the Department of Militia in advertising for recruits in Canada, showing the persons, firms and corporations to whom the payments were made, up to April 1, 1917. Presented May 31, 1917.—*Mr. Macdonald*.. .. ..*Not printed.*

172. Finding of the Court of Inquiry appointed by the Adjutant-General by Orders dated the 1st May, 1917, for the purpose of collecting and recording evidence in connection with the allegations contained in several newspapers that Troop Trains had been stoned passing through Rivière-du-Loup, Quebec, and other places, and for the purpose of collecting and recording any other evidence which, in the opinion of the Members of the Court, in any way relates to or has a bearing on this matter. Presented by Sir Edward Kemp, May 31, 1917.. .. ..*Not printed.*

173. Finding of the Court of Inquiry appointed by the Adjustant-General by Orders dated the 1st May, 1917, for the purpose of collecting and recording evidence in connection with the allegations contained in several newspapers accusing the citizens of Quebec of maltreating or allowing to be maltreated, soldiers returning from the War and passing through or sojourning in Quebec, and for the purpose of collecting and recording any other evidence which, in the opinion of the Members of the Court, in any way relates to or has a bearing on the matter. Presented by Sir Edward Kemp, May 31, 1917... .. ..*Not printed.*

174. Return to an Order of the House, of the 7th May, 1917, for a copy of all accounts, letters, claims, correspondence and other documents relating to the following amounts mentioned in the Report of the Auditor General 1916, Vol. 11, page L—11:—Mr. Justice L. P. Pelletier, travelling expenses, $877; Mr. Justice I. N. Belleau, travelling expenses, $1,984.44; Mr. Justice T. H. Chauvin, travelling expenses, $1,421.25; Mr. Justice B. LeTellier, travelling expenses, $1,923.80. Presented May 31, 1917.—*Mr. Lanctot*.. .. ..*Not printed.*

175. Return to an Order of the House, of the 30th May, 1917, for a Return showing:—1. The number of persons appointed to permanent position on the Canadian Government Railways from January 1, 1916, to March 31, 1917, who were not previously employed on the said Railways. 2. Their names, salaries and the positions to which they were appointed. Presented May 31, 1917.—*Mr. Copp*.. .. ..*Not printed.*

CONTENTS OF VOLUME 21—*Continued.*

176. Return to an Order of the House, of the 12th February, 1915, for a Return showing how many persons of German nationality are employed in the several Departments of the Federal Government, in what capacity and the salaries received respectively. Presented June 1, 1917.—*Mr. Delisle*.. .. ..*Not printed.*

177. Return to an Order of the House, of the 1st May, 1916, for a copy of all correspondence and papers relating to the change in the location of the post office at Roseberg, Alberta. Presented June 1, 1917.—*Mr. Buchanan*.. .. ..*Not printed.*

178. Return to an Order of the House, of the 8th May, 1916, for a copy of all correspondence, letters and telegrams relating to the dismissal of Augustin D. Lauteigne as Postmaster of Island River, Gloucester County, N.B. Presented June 1, 1917.—*Mr. Turgeon.*
Not printed.

179. Return to an Order of the House, of the 31st January, 1917, for a copy of all letters and telegrams in the Post Office Department in reference to the removal of Pearson's Post Office, Township of Casey, in the Constituency of Nipissing, from where it was located to its present location. Presented June 1, 1917.—*Mr. Turriff*.. ..*Not printed.*

180. Return to an Order of the House, of the 5th February, 1917, for a copy of all letters, reports, papers and other documents relative to the dismissal of John R. McIntosh as Postmaster of Cummings Mountain, Pictou County, and the appointment of James Cummings as his successor. Presented June 1, 1917.—*Mr. Macdonald*.. ..*Not printed.*

181. Return to an Order of the House, of the 2nd May, 1917, for a Return showing:—The gross amount paid by the Government since October, 1911, to H. P. Duchemin, of Sydney, N.B., for services and disbursements under the Public Inquiries Act, or otherwise. Presented June 1, 1917.—*Mr. Sinclair*.. .. ..*Not printed.*

182. Return to an Order of the House, of the 3rd February, 1917, for a copy of all correspondence, letters, telegrams and other documents concerning the cancelling by the Post Office Department of the rural mail contract granted to Hyppolite Lambert of St. Antoine, in the County of Lotbinière, Que. Presented June 1, 1917.—*Mr. Fortier.*
Not printed.

183. Reports, pursuant to a Resolution of the House adopted on the 18th May, 1916, based on a recommendation of the Joint Committee of both Houses on Printing of Parliament, requesting information from the several Departments of Government with the view to effecting all possible economy in the matter of public printing and the distribution of public documents, and the extent, if any, to which such recommendations have been carried into effect. Presented by Hon. Mr. Patenaude, June 1, 1917.. ..*Not printed.*

184. Return to an Order of the House, of 21st May, 1917, for a copy of all correspondence, reports and recommendations, if any, from the Grain Commission to the Department of Trade and Commerce or any other Department of the Government at Ottawa, following a meeting of the Grain Commissioners held in Lethbridge this year. Presented June 1, 1917.—*Mr. Buchanan*.. .. ..*Not printed.*

185. Order in Council passed in conformity with provisions of 4-5 George V., Chapter 20, S-15 (C. N. Railway.)—(*The Senate*).. .. ..*Not printed.*

186. Return to an Order of the House, of the 3rd February, 1917, for a return showing the quantity and value of exports in following commodities for the first nine months of present fiscal year:—Horses; brass and manufacturers of same; wheat, breadstuffs; oats and grain other than wheat; automobiles, bicycles, motorcycles and parts of same, including engines and tires; railway cars and parts; chemicals; copper and manufactures of same; cotton manufactures; explosives; iron and steel and manufactures of same; firearms and munitions; leather and manufactures of same; meat and dairy products; alcohol; vegetables, dried and canned; lead; wearing apparel of all kinds; zinc and manufactures of same; paper and manufactures of same. Presented June 4, 1917.—*Mr. Maclean (Halifax)*... .. ..*Printed for sessional papers only.*

CONTENTS OF VOLUME 21—*Continued.*

187. Return to an Order of the House, of the 30th April, 1917, for a copy of all documents, correspondence, letters, telegrams, memoranda and reports exchanged between the Sergeant-at-Arms of the House of Commons and the Honourable Albert Sévigny; the Sergeant-at-Arms and the Justice Department, and between the Department of Justice and the Honourable Albert Sévigny, concerning certain effects, furniture and ornaments connected with the Speaker's Apartments. Also, copy of all accounts, receipts, bills of lading and transportation accounts concerning the said effects, furniture and ornaments. Presented June 5, 1917.—*Mr. Lanctot*.. .. ..*Not printed.*

188. Copy of Order in Council P.C. 1457, dated the 29th May, 1917, respecting pay to members of the Civil Service who join the Military forces of Canada either by voluntary enlistment or otherwise from and after the date hereof. Presented by Sir Thomas White, June 6, 1917... .. ..*Not printed.*

189. Copy of General Reports of W. F. O'Connor, K.C., Acting Commissioner *re* Cost of Living, concerning the production, cost, selling prices, and distribution system of refined sugar. Presented by Hon. Mr. Crothers, June 6, 1917

Printed for distribution and sessional papers.

190. Copy of Reports of W. F. O'Connor, on the subject of the Anthracite Coal business in Canada. Presented by Hon. Mr. Crothers, June 6, 1917.

Printed for distribution and sessional papers.

191. Return to an humble Address of the Senate to His Excellency the Governor General, dated the 22nd of May last, showing a copy of:—All correspondence exchanged between the Government or its Ministers, the Minister of Militia, the Militia Council, Major-General F. L. Lessard, C.B., Inspector-General, or any other person, and Lieutenant-Colonel Armand Lavergne, O.C., the 61st Regiment or any other person, on the subject of the territorial defence of the Province of Quebec, as well as copy of all Orders in Council or documents relating to this subject.—(*Senate*).. .. ..*Not printed.*

192. Copy of Order in Council, P.C. 1579, dated 8th June, 1917, appointing a Fuel Controller for Canada. Presented by Sir George Foster, May 12, 1917.

Printed for sessional papers only.

192*a*. Copy of Order in Council, P.C. 1460, dated 16th June, 1917, *re* the appointment of an Officer to be known as Food Controller for Canada, and specifying his powers and duties. Presented by Sir Robert Borden, June 19, 1917.

Printed for sessional papers only.

193. Copy of Order in Council, P.C. 1604, dated 11th June, *re* the establishment of "The Board of Grain Supervisors of Canada." And also, Copy of Order in Council, P.C. 1605, dated 11th June, 1917, appointing certain persons as members of "The Board of Grain Supervisors of Canada." Presented by Sir George Foster, May 12, 1917.

Printed for sessional papers only.

194. Copies of Census Statistics of male population of Canada, Census of 1911, between the ages of 20 and 45, both years inclusive, according to conjugal condition and nativity. Presented by Sir Edward Kemp, June 13, 1917.

Printed for sessional papers only.

195. Copies of The King's Regulations and Orders for the Army, 1912, re-printed with amendments published in Army Orders up to 1st August, 1914. Presented by Sir Edward Kemp, June 13, 1917... .. ..*Not printed.*

196. Copies of Manual of Military Law, War Office, 1914. Presented Sir Edward Kemp, June 13, 1917.. .. ..*Not printed.*

197. Copy of Order in Council, P.C. 987, dated 10th April, 1917, as amended by Order in Council No. 1451, dated 25th May, 1917: Regulations, being as Consolidation of and additions to various Orders in Council made in consequence of the War, the whole to be known as the "Defence of Canada Order, 1917." Presented by Hon. Mr. Hazen, June 13, 1917... .. ..*Not printed.*

CONTENTS OF VOLUME 21—*Continued.*

198. Return to an Order of the House, of the 14th May, 1917, for a copy of all letters, petitions, correspondence, telegrams and reports in any way referring to dismissal, retirement or resignation of John McDonald, as Janitor of public building at Inverness, and the appointment of his successor. Presented June 15, 1917.—*Mr. Chisholm.* *Not printed.*

199. Return to an Order of the House, of the 14th May, 1917, for a copy of all letters, petitions, correspondence, telegrams and reports received by the Government since September, 1911, to the present day, in any way referring to the extension and repairs to McKay's Point Wharf, Inverness County. Presented June 15, 1917.—*Mr. Chisholm*.. .. .. .

CONTENTS OF VOLUME 21—*Continued.*

206. Letter of the Honourable E. L. Patenaude, M.P., to the Right Honourable the Prime Minister, resigning his position as Secretary of State for Canada, and the letter of the Prime Minister in acknowledgment thereof. Presented by Sir Robert Borden, June 18, 1917.. .. ..*Not printed.*

207. Return to an Order of the House, of the 3rd May, 1917, for a Return showing:—1. How much merchandise has been exported from Canada into Foreign Countries since the first of August, 1914, to the present time? 2. How much of these goods have gone through the Port of Hamburg? 3. What countries have imported this merchandise from Canada, and the respective amounts for each of them? Presented June 18, 1917.—*Mr. Verville*.. .. ..*Not printed.*

208. Return to an Order of the House, of the 3rd February, 1916, for a return showing the itemized disbursements of Ward Fisher, Inspector of Fisheries for Western Nova Scotia, for the year 1912, amounting to $388.40, and the year 1913, amounting to $1,009.84. Presented June 18, 1917.—*Mr. Law*.. .. ..*Not printed.*

209. Return to an Order of the House, of the 23rd April, 1917, for a copy of all papers, documents, petitions, memoranda, correspondence, etc., with the Government of British Columbia or any member thereof with the Fishery Officers of the Marine and Fisheries Department resident in said Province, and with any Company, person or persons relating to prohibition of the export of British Columbia salmon since January 20, 1913. Presented June 18, 1917.—*Mr. McKenzie*.. .. ..*Not printed.*

210. Statement of Amount and Price of Commodities purchased and sold (including export and home consumption) by Cold Storage Companies in Canada from January 1 to December 1, 1916. Presented by Hon. Mr. Crothers, June 18, 1917.. .. .. ..*Not printed.*

210*a*. Report of W. F. O'Connor, K.C., Acting Commissioner *re* Cost of Living, concerning Cold Storage Conditions in Canada. Presented by Hon. Mr. Crothers, July 13, 1917. *Printed for distribution and sessional papers.*

210*b*. Copy of Order in Council, P.C. 2021, dated 23rd July, 1917, recommending the further investigation into the premises, books, papers and records of the William Davies Company, Limited, and Matthews-Blackwell, Ltd., as disclosed by the report of W. F. O'Connor, Acting Commissioner on the Cost of Living, on the subject of cold storage conditions in Canada, and appointing G. F. Henderson, A. B. Brodie and Geoffrey Clarkson with all the powers of Examiners under Part I of the Inquiries Act to inquire into the books, papers, etc., of the said companies; also to recommend in writing to the Minister of Labour a standardized system of costs accounting applicable to the cold storage business by which the net profits of cold storage companies in Canada may from time to time be readily ascertained. Presented by Hon. Mr. Crothers, July 25, 1917.. .. ..*Not printed*

211. Return to an Order of the House, of the 11th June, 1917, for a copy of all correspondence, telegrams, requests, petitions and other papers in the possession of the Department of Trade and Commerce relating to providing a supply of salt for the fisheries of the Maritime Provinces. Presented by Sir George Foster, June 22, 1917. *Not printed.*

212. Copy of Order in Council, P.C. No. 1725, dated the 25th June, 1917, creating the position of Director of Coal Operations for the southeastern coal fields of the Province of British Columbia and the suthwestern coal fields of the Province of Alberta, known as District 18. And also,—Copy of Order in Council, P.C. No. 1726, dated the 25th June, 1917, appointing W. H. Armstrong, of the City of Vancouver, Director of Coal Operations under the provisions of the above Order in Council, P.C. No. 1725, dated 25th June, 1917. Presented by Sir Robert Borden, June 25, 1917... ..*Not printed.*

212*a*. Return to an Order of the House, of the 14th May, 1917, for a copy of all letters, reports, communications and documents passing between the Minister of Labour and the Department of Labour and the officials of District No. 18, United Mine Workers

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of Alberta, and the officials of the Alberta and Eastern British Columbia Coal Operators' Association, concerning the requests made by the Miners for an increase in wages due to the increase in the cost of living, between September 1, 1916, and the present time. Presented July 12, 1917.—*Mr. Buchanan*.. .. ..*Not printed.*

213. Return to an Order of the House, of the 13th June, 1917, for a Return showing:—1. How many battalions of infantry left Canada with the First Contingent? 2. The number, and the designations of the different units of artillery which left with the First Contingent? 3. The number and the designation of the different medical corps which left Canada with the First Contingent? 4. The number and the designation of all the other units which left with the First Contingent? 5. The names, rank and duties of the supernumerary officers who left with the First Contingent. Presented June 26, 1917.—*Mr. Lachance*.. .. ..*Not printed.*

214. Return to an Address to His Excellency the Governor General, of the 30th May, 1917, for a copy of all correspondence, letters, cables and other documents exchanged between the Imperial Government or any of its members or officials with the Canadian Government or any of its members or officials, relative to the question of the proposed legislation by the Imperial Parliament to validate certain Acts and proceedings of the Legislature of British Columbia. Presented June 27, 1917.—*Mr. Macdonald*.. .. ..*Not printed.*

215. Return to an Order of the House, of the 4th June, 1917, for a copy of all correspondence between the Chief of the *Hansard* Translation Staff of the House, the Clerk of the House and the Speaker, since April 19, 1917, to date. Presented June 28, 1917.—*Mr. Lemieux*.. .. ..*Not printed.*

216. Return to an Order of the House, of the 27th March, 1916, for a return showing the amounts paid by the Federal Government from the 1st July, 1896, to the 1st October, 1911, to the following newspapers: Le *Canada, La Presse, La Patrie, Le Pays,* of Montreal, *La Vigie* and *Le Soleil,* of Quebec. Presented June 28, 1917.—*Mr. Boulay*.. .. ..*Not printed.*

217. Return to an Order of the House, of the 3rd May, 1917, for a Return showing the number of employees of the following Departments after 1896, and after 1911, respectively, viz.:—Inland Revenue, Interior, Public Works, Marine and Fisheries, Militia and Defence, Labour and Department of Trade and Commerce. Presented June 28, 1917.—*Mr. Boulay*.. .. ..*Not printed.*

218. Return to an Order of the House, of the 7th May, 1917, for a Return showing the number of returned soldiers who have been given employment in the various departments of the Government. Presented June 28, 1917.—*Mr. Lemieux*.. ..*Not printed.*

219. Return to an Order of the House, of the 25th June, 1917, for a copy of the reports made by the Penitentiary Surgeons in connection with the release from Penitentiary of Edward Levi Baugh. Presented July 4, 1917.—*Mr. Murphy*.. .. ..*Not printed.*

220. Return to an Order of the House, of the 21st May, 1917, for a return giving the names and salaries of employees of the Interior and Indian Departments, (*a*) Inside Service and (*b*) Outside Service, who volunteered for overseas service, and who were paid their full civil salary in addition to their military pay and allowances.

Those who volunteered for overseas service and who were paid a sufficient portion of their civil salary in addition to their military pay and allowances to bring their pay up to the amount of their civil salary.

Those who volunteered for overseas service and who received consideration (stating consideration) on account of their civil employment in addition to their military pay and allowances.

Those who volunteered for overseas service and who do not receive any consideration on account of their civil employment in addition to their military pay and allowances. Presented July 5, 1917.—*Mr. Oliver*.. .. ..*Not printed.*

CONTENTS OF VOLUME 21—*Continued.*

221. Report of Special Trade Commission to Great Britain, France and Italy, May-September, 1916. Presented by Sir George Foster, July 5, 1917... ..*Not printed.*

222. Return to an Order of the House, of the 13th June, 1917, for a Return showing:—1. The total expenditure connected with Agriculture by the Federal Government in each of the fiscal years from 1904-05 to 1916-17, inclusive. 2. How much money was set apart by the Agricultural Aid Act of 1912 to assist the Provincial Departments of Agriculture to improve and extend their work? 3. How much of above amount was given to each Province, and what was accomplished in each Province as a result of such assistance? 4. How much money was set apart by the Federal Government under the Agricultural Instructions Act of 1913, and under the provisions of the said Act what amounts were respectively allotted each year to the several Provinces? 5. What the general purpose of said Act is, and to what extent that purpose has been made effective in each Province. Presented July 5, 1917.—*Mr. Edwards.*
Printed for sessional papers only.

223. Return to an Order of the House, of the 11th June, 1917, for a Return showing:—1. Whether Mr. Giard, ex-M.P.P. for Compton, is an employee of the Government? 2. If so, since when? 3. The number of employees under his orders and their respective names? 4. What salary does said Giard receive? 5. The salary of each employee under his charge? 6. Whether he has bought, for the Government, any animals for breeding purposes? 7. If so, how many, and the price paid for each? 8. Where these animals were bought? 9. How many of them have been rejected or returned to the Government or to Mr. Giard? 10. If any have been refused or returned, why? 11. Where the said breeding animals are at present? 12. What the Government or the Department of Agriculture intends to do with the animals so refused and returned to Mr. Giard? Presented July 5, 1917.—*Mr. Gauvreau* *Not printed.*

224. Return to an Address to His Excellency the Governor General, of the 31st January, 1917, for a copy of all documents, letters, messages, correspondence, reports and particularly an Order in Council dated 6th December, 1898, respecting the exemption from military service of the Doukhobors. Presented by Hon. Mr. Roche, July 9, 1917. —*Mr. McCraney*.. .. ..*Not printed.*

225. Return to an Address to His Excellency the Governor General, of the 31st January, 1917, for a copy of all Orders in Council and other documents on file in the Department of Marine and Fisheries relating to the requisitioning of Canadian ships by the Canadian Government. Presented July 11, 1917.—*Mr. Sinclair*.. .. ..*Not printed.*

226. Return to an Order of the House of the 7th June, 1917, for a return showing the number of recruiting officers which have been appointed in the province of Quebec, with the names, addresses, nature of functions and salaries of the same. Presented July 11, 1917.—*Mr. Carvell*.. .. ..*Not printed.*

226*a*. Return to an Order of the House of the 18th June, 1917, for a return showing:—1. The names and addresses of the parties on Prince Edward Island who have been engaged or who are now engaged in recruiting for the army and navy or doing other work of a like military character, since August, 1914. 2. The remuneration or pay each of the said parties receives and the allowance given for travelling or other expenses. 3. The total amount each person has received up to the 1st of June, 1917. Presented July 31, 1917.—*Mr. Hughes (P.E.I.)*.. .. ..*Not printed.*

227. Return to an Order of the House of the 12th April, 1916, for a return showing:—1. How many clerks there are in the Post Office Department who belong to and are paid from the outside service vote, and who work in the inside service. 2. The names of said clerks. 3. Salary paid to each. 4. How long each has been in the service of the Department. 5. If all or any of the clerks have passed any examination. If so, what examination, and on what date or dates. Presented July 14.—*Mr. Turriff*..*Not printed.*

228. Copy of a memorandum presented by the Southern Slav Committee to the representatives of the British Dominions, setting forth the aims and aspirations of the Jugo-slavs (Serbs, Croats and Slovens) subject to Austro-Hungarian rule. Presented by Sir Robert Borden, July 20, 1917.. .. ..*Not printed.*

CONTENTS OF VOLUME 21—*Continued.*

229. Claims made by Minister of Justice relating to payment of duties by certain provinces. (*Senate.*).. .. ..*Not printed.*

230. Copy of Report of Honourable Sir Ezekiel McLeod, Chief Justice of the Province of New Brunswick, and the Honourable Louis Tellier, retired Judge of the Superior Court of the Province of Quebec, Commissioners appointed under the Inquiries Act of Canada, being Revised Statutes of Canada, 1906, Chapter 104 and Amending Acts, by virtue of an Order in Council passed on the 6th June, 1917, whereby the said Commissioners were empowered and directed to conduct an inquiry and investigation for the purpose of reviewing and considering the evidence taken by Mr. Justice Galt, a Commissioner appointed by the Lieutenant-Governor of Manitoba on the 15th day of July, 1916, to investigate and report upon certain matters of concern to the Local Government of the said province, in the execution of such Commission, and to review and consider his reports and findings on such evidence; and to report whether such evidence sustains or supports the findings of the said Commissioner, as set forth in such reports, in so far as they reflect upon or prejudicially affect the honour or integrity of the Hon. Robert Rogers or the honesty of his dealings or transactions. Presented by Hon. Mr. Doherty, July 27, 1917.. ..*Printed for distribution—Members and Senators only.*

230*a*. Copy of evidence, exhibits, etc., in respect to the Report of Honourable Sir Ezekiel McLeod, Chief Justice of the Province of New Brunswick, and the Honourable Louis Tellier, retired Judge of the Superior Court of the Province of Quebec, Commissioners appointed under the Inquiries Act of Canada, being Revised Statutes of Canada, 1906, Chapter 104 and Amending Acts, by virtue of an Order in Council passed on the 6th June, 1917, whereby the said Commissioners were empowered and directed to conduct an inquiry and investigation for the purpose of reviewing and considering the evidence taken by Mr. Justice Galt, a Commissioner appointed by the Lieutenant-Governor of Manitoba on the 15th day of July, 1916, to investigate and report upon certain matters of concern to the Local Government of the said province, in the execution of such Commission, and to review and consider his reports and findings on such evidence; and to report whether such evidence sustains or supports the findings of the said Commissioner as set forth in such reports, in so far as they reflect upon or prejudicially affect the honour or integrity of the Hon. Robert Rogers, or the honesty of his dealings or transactions. Presented by Hon. Mr. Doherty, August 9, 1917.. .. ..*Not printed.*

231. Return to an Order of the House of the 13th June, 1917, for a copy of all correspondence, letters, telegrams and other papers relating to a contract for carrying mails between Grand River and Fourchu, in the County of Richmond, Nova Scotia, in the years 1916 and 1917. Presented July 28, 1917.—*Mr. Kyte*.. .. ..*Not printed.*

232. Return to an Order of the House of the 30th April, 1917, for a copy of all papers, letters, telegrams and documents relative to the purchase of land in Vancouver, B.C., for the purpose of an armoury, since January 1, 1913. Presented July 30, 1917.—*Mr. Macdonald*.. .. ..*Not printed.*

233. Return to an Order of the House of the 1st February, 1917, for a return showing:—1. The names and present rank of all appointees as Chief Recruiting Officers or as District or Special Recruiting Officers, not local or regimental, made since the beginning of the war. 2. The dates of their respective appointments. 3. The ages and vocations of respective appointees. 4. The name of military organization, if any, in which appointees had previously served. 5. The rank of appointees while serving in any military organization. 6. Whether the services of any of these appointees have been dispensed with. 7. If so, their names, and dates on which they were retired. Presented July 31, 1917.—*Mr. Turriff*.. .. ..*Not printed.*

234. Return to an Order of the House of the 31st January, 1917, for a return showing:—1. The date of the last order given by the Government to the Ross Rifle Company. 2. The number of rifles ordered. 3. Whether a recommendation of the British Army Council for the utilization of existing Canadian facilities in manufacturing the new and improved Lee-Enfield was received by the Government. 4. The date of the recommendation, and when it was received. 5. Whether the recommendation has been acted upon. Presented July 31, 1917.—*Mr. Turriff*.. .. ..*Not printed.*

CONTENTS OF VOLUME 21—*Continued.*

235. Return to an Order of the House of the 20th June, 1917, for a return showing:—1. The names of the members of the military staff at North Vancouver. 2. Their respective duties or occupations. 3. The rank and rate of pay of each. 4. The amount that has been paid to each. 5. Upon what date or dates the members of the said staff enlisted, and how long they have been attached to the staff. Presented July 31, 1917.—*Mr. Murphy*.. .. ..*Not printed.*

235*a*. Return to an Order of the House of the 21st June, 1917, for a return showing the names, rank, pay, and nature and place of employment of all officers attached to headquarters at Halifax and the various departments of the military service or connected in any way with Military Division No. 6. Presented August 2, 1917.—*Mr. Tobin*.. ..*Not printed.*

236. Return to an Order of the House of the 18th July, 1917, for a return giving a list of the different Commissions created since the beginning of the war, concerning the soldiers, their pensions, hospitals, etc., showing the names of the various Commissioners who have comprised said Commissions. Presented July 31, 1917.—*Mr. Boulay*.. .. ..*Not printed.*

237. Copy of Financial Statements in respect to the Canadian Northern Railway System: 1. Balance Sheet, 30th June, 1916. 2. Statement of Securities Issued and Fixed Charges, 30th June, 1917. 3. Statement of Liabilities, 15th June, 1917. 3*a*. Statement of Equipment Account. 4. List of Securities for Loans. 5. Gross and Net Earnings, 30th June, 1917. 6. Comparison of Earnings, 1915, 1916 and 1917. 7. Statement *re* Capital Expenditure and Betterments, year ending 30th June, 1917. 8. Mileage. And also,—Statements showing bonds, etc., authorized, issued and outstanding, and net proceeds therefrom; interest payable during the period July 1, 1917, to June 30, 1918; and estimated cash requirements for period July 1, 1917, to June 30, 1918, in respect to the Grand Trunk Railway and Grand Trunk Pacific Branch Lines. Presented by Sir Robert Borden, July 20, 1917.. .. ..*Not printed.*

237*a*. Copy of Mortgage Deed of Trust securing an issue of $45,000,000 of Canadian Northern Railway securities, guaranteed by the Dominion Government, issued under the legislation of 1914. Also,—Copy of Mortgage Deed dated 26th June, 1916—The Canadian Northern Ontario Railway Company to His Majesty the King—securing certain advances from a loan of $15,000,000 made by His Majesty to the Canadian Northern Railway Company. And also,—Copy of Audit of Revenue and Expenditure Accounts of the Canadian Northern Railway System for the months of May, June, July, August, September, October, November and December, 1916, and for January and February, 1917. Presented by Sir Thomas White, August 8, 1917.. .. ..*Not printed.*

237*b*. Statement of amounts advanced by the Government of Canada to the Canadian Northern Railway Company on interest account to date. And also,—Financial Statements of the Canadian Northern Railway, as follows:—1. Interim Condensed Balance Sheet as at April 30, 1917. 2. Statement of estimate of cost to complete lines and terminals under construction and financial provision for same. 3. Statement of Contractors' and other Construction accounts outstanding, 30th June, 1917. 4. Memorandum *re* unsold lands. 5. Estimate of amount required for betterments and rolling stock for three years. Presented by Sir Thomas White, August 13, 1917.. .. ..*Not printed.*

238. Copy of Order in Council, P.C. 1881, dated 19th August, 1916, recommending that in the case of officers, warrant officers and non-commissioned officers reverting to lower rank in order to proceed to the front, no reduction in separation allowance or pension shall be made. And also,—Copy of Order in Council, P.C. 2008, dated 20th July, 1917, cancelling Order in Council, P.C. 1615, dated 13th June, 1917, and amending Order in Council, P.C. 1881, dated 19th August, 1916, in respect to separation allowances and pensions to those reverting to lower rank, in order to proceed to the front. Presented by Sir Edward Kemp, August 2, 1917.. .. ..*Not printed.*

239. Return to an Order of the House of the 30th July, 1917, for a copy of all correspondence exchanged between the Board of Trade of the City of Quebec and the Prime Minister on the subject of the Report of the Special Commission on Railways. Presented August 2, 1917.—*Sir Wilfrid Laurier*.. .. ..*Not printed.*

CONTENTS OF VOLUME 21—*Continued.*

240. Return to an Order of the House of the 13th June, 1917, for a statement showing the travelling expenses of Maurice LeBlanc, general foreman of the Department of Public Works, Bonaventure County, since his appointment to date. Presented August 8, 1917. —*Mr. Marcil (Bonaventure)*.. .. ..*Not printed.*

241. Return to an Order of the House of the 30th April, 1917, for a copy of all letters, petitions, correspondence and telegrams exchanged between the Government, the resident engineer and all other persons concerning the dredging work done at Ste. Anne de Bellevue, Pointe Fortune, Ottawa River channel between Ile au Foin and Ile Paquin, Graham channel, Rigaud channel, Hudson Heights channel, Ile Perrot Church, Ile Perrot South wharf and Ile Perrot North wharf, since 1904. Also a statement showing the amounts paid to different persons or companies for such work, giving the dates of payment, along with a copy of the estimates already brought down at my request regarding the above, previous to 1904. Return to an Order of the House of the 30th April, 1917, for a copy of all letters, petitions, correspondence, telegrams and reports exchanged between the Government, the resident engineer of the district, and all other persons, concerning the dredging work done since 1904 at the wharf of Ile Perrot North, South and the Church, Dorion Bay channel, Vaudreuil Village channel, Pointe Cavagnal, Como, Hudson Heights channel, Graham channel, Rigaud River channel, Ottawa River, Iles aux Poires channel, Pointe Fortune and Ste. Anne de Bellevue channel. Also a statement showing the amount of money paid to divers persons, companies, etc., for such works, along with copy of statements already presented at my request in connection with the same work, previous to 1904. Presented August 8, 1917. —*Mr. Boyer*.. .. ..*Not printed.*

242. Return to an Order of the House of the 14th May, 1917, for a copy of all letters, petitions, correspondence, telegrams and reports received by the Government since September, 1911, to the present day, in any way referring to the extension and repairs to Finlay Point wharf. Presented August 8, 1917.—*Mr. Chisholm*.. .. .. ..*Not printed.*

243. Return to an Order of the House of the 30th April, 1917, for a copy of all correspondence in the possession of the Department of Public Works bearing date after September 1, 1915, relating to wharves, breakwaters and other public works situate in the County of Antigonish, Nova Scotia. Presented August 8, 1917.—*Mr. Sinclair*.. .. ..*Not printed.*

244. Return to an Order of the House of the 7th May, 1917, for a copy of all documents, correspondence, reports, accounts, pay-lists, etc., in connection with the work done on the Government wharves at Cross Point, Miguasha, St. Omer and New Carlisle, Quebec, since 1912. Presented August 8, 1917.—*Mr. Marcil (Bonaventure)*... ..*Not printed.*

245. Return to an Order of the House of the 14th May, 1917, for a copy of all letters, petitions, correspondence, telegrams and reports received by the Government since September, 1911, to the present day, in any way referring to the wharf at Marble Mountain. Presented August 13, 1917.—*Mr. Chisholm*.. .. ..*Not printed.*

246. Return to an Order of the House of the 14th May, 1917, for a copy of all letters, petitions, correspondence, telegrams and reports received by the Government since September, 1911, to the present day, in any way referring to the extension of the pier at Margaree Harbour. Presented August 13, 1917.—*Mr. Chisholm*.. .. .. ..*Not printed.*

246a. Return to an Order of the House of the 14th May, 1917, for a copy of all letters, petitions, correspondence, telegrams and reports received by the Government since September, 1911, to the present day, in any way referring to the breakwater at Margaree Harbour. Presented August 13, 1917.—*Mr. Chisholm*.. .. ..*Not printed.*

247. Return to an Order of the House of the 14th May, 1917, for a copy of all letters, petitions, correspondence, telegrams and reports received by the Government since September, 1911, to the present day, in any way referring to the Port Hood wharf. Presented August 13, 1917.—*Mr. Chisholm*.. .. ..*Not printed.*

CONTENTS OF VOLUME 21—*Continued.*

248. Return to an Order of the House of the 14th May, 1917, for a copy of all letters, petitions, correspondence, telegrams and reports received by the Government since September, 1911, to the present time, in any way referring to the opening of Inverness Harbour. Presented August 13, 1917.—*Mr. Chisholm*.. .. ..*Not printed.*

249. Return to an Order of the House of the 23rd April, 1917, for a copy of all papers, documents, petitions, memoranda, correspondence, etc., with reference to the Government of the Dominion of Canada building competing telephone lines in British Columbia paralleling lines already in operation of the Okanagan Telephone Company, Limited. Presented August 13, 1917.—*Mr. Carvell*.. .. ..*Not printed.*

250. Return to an Order of the House of the 30th April, 1917, for a copy of all correspondence in the Department of Public Works bearing date after September 1, 1915, relating to wharves, breakwaters and other public works in the County of Guysborough, Nova Scotia. Presented August 13, 1917.—*Mr. Sinclair*.. .. ..*Not printed.*

251. Return to an Order of the House of the 30th April, 1917, for a copy of all papers, records and other documents concerning the reference by the Dominion Government to the question relating to the exclusive right of fishing in the tidal waters of the province of Quebec. Presented August 15, 1917.—*Mr. Lemieux*.. .. ..*Not printed.*

252. Return to an Order of the House of the 9th July, 1917, for a return showing the names of all persons employed in connection with the Office of the Commissioner of Live Stock in the Province of Saskatchewan, showing the salaries and expenses paid them; and also showing the number of stallions and bulls placed in Saskatchewan when the said office was established. Presented August 15, 1917.—*Mr. Thomson (Qu'Appelle)*.
Not printed.

253. Return to an Order of the House of the 14th May, 1917, for a copy of all letters, telegrams and reports between the Department of the Naval Service of the Department of Marine and Fisheries, and any and all persons in connection with the seizure of certain fishery boats, fishing tackle and equipment being used in the illegal fishing of lobsters in the Straits of Northumberland in the fall of 1916, together with a copy of the evidence taken before one M. G. Teed, Esquire, acting as a commissioner to inquire into this matter, and his report and finding thereon. Presented August 16, 1917.—*Mr. Copp.*
Not printed.

254. Return to an Order of the House of the 30th July, 1917, for a copy of all correspondence between the Department of Militia and Defence of Canada, the War Purchasing Commission of Canada, and the British War Office, concerning a target practice rod or the use of same by the Canadian Expeditionary Force. Presented August 20, 1917.—*Mr. Maclean (Halifax)*.. .. ..*Not printed.*

255. Return to an Order of the House of the 7th June, 1917, for a return showing:—1. Whether the Department of Agriculture supply thoroughbred bulls for improvement of stock to applicants for the same. 2. If so, if any such bulls have been sent into the County of Dorchester, Quebec, and when. 3. At whose request these bulls were sent, and if they belonged to the Department of Agriculture. 4. If so, on what condition they were supplied. 5. From whom the department purchased the animals referred to. 6. The price paid. 7. If any official of the Department of Agriculture has made an investigation as to where these bulls are at the present time. 8. If so, the substance of their report. 9. Whether the said bulls are being used for the purpose for which they were intended. Presented August 21, 1917.—*Mr. Lanctôt*.. .. .. ..*Not printed.*

256. Return to an Order of the House of the 1st August, 1917, for a return showing the amount which has been paid to the Sydney *Daily Post*, newspaper, by all the departments of the Government for printing and advertising, since the 1st of November, 1911. Presented August 21, 1917.—*Mr. Kyte*.. .. ..*Not printed.*

257. Return to an Order of the House of the 1st August, 1917, for a return showing the gross amount paid to the Halifax *Herald*, the *Evening Mail*, Halifax, and the Royal Print and Lithographing Company, Halifax, by all the departments of the Government for printing, advertising and all other services since November 1, 1911. Presented August 21, 1917.—*Mr. Sinclair*.. .. ..*Not printed.*

CONTENTS OF VOLUME 21—*Continued.*

258. Return to an Order of the House of the 18th June, 1917, for a copy of all accounts, papers, claims and correspondence regarding demands put forward by all persons who have claimed to have sustained loss or damage by the fire in the Parliament Buildings in February, 1916. Presented August 21, 1917.—*Mr. Lanctôt*.. .. ..*Not printed.*

259. Return to an Order of the House of the 14th May, 1917, for a copy of all communications, letters, reports, petitions and other documents on behalf of the Physicians and Medical Associations of this country, asking for the repeal of The Proprietary or Patent Medicine Act and the presentation of a new Act on the matter in order to render more efficient the control of these medicine preparations, and to add on the prohibition list such drugs or medicines as are generally dangerous to health and conducive to certain criminal practices. Presented August 21, 1917.—*Mr. Lapointe* (*Kamouraska*).
Not printed.

260. Copy of correspondence between the Honourable Robert Rogers and the Right Honourable Sir Robert Borden, Prime Minister, with reference to the resignation of the former as Minister of Public Works of Canada.—(*The Senate.*).. .. ..*Not printed.*

261. Return to an Order of the Senate dated the 11th day of July, 1917, for a Statement showing the number of officers and men of the Canadian Expeditionary Force who have been classed as unfit for military service; whether the military authorities have given consideration to the possibility of utilizing the services of those men in a secondary capacity; whether those who have been classed as unfit continue to draw military pay; the number who have deserted from the various units between 1st October, 1914, and 1st June, 1917; and the number discharged from the various units since 1st October, 1914.—(*The Senate.*).. .. ..*Not printed.*

262. Return to an Order of the Senate, dated 7th June last, for a return showing:—1. The name and rank of each person who at the outbreak of the war in August, 1914, was an officer, commissioned or provisional, of the 78th Regiment (Highlanders), of Pictou County, Nova Scotia. 2. The length of time each of such persons was attached to said regiment. 3. (*a*) The name of each of said officers who joined the Canadian Overseas Forces. (*b*) The unit to which he was attached. (*c*) The rank with which he was attached. (*d*) The date at which he was attached. 4. The name of each person who since the outbreak of war became attached as provisional officers to said 78th Regiment and the date at which such person became attached and his rank. 5. (*a*) The name of each of the officers referred to in paragraph 4 who joined the Canadian overseas forces. (*b*) The unit to which he was attached. (*c*) The rank with which he was attached. (*d*) The date at which he was attached. 6. The name of each of the officers referred to in each of the foregoing paragraphs who were in active service at the fighting front, the units with which they served, and the length of time they served. 7. Particulars as to each of the said officers showing where each one was on May 1, 1917, to what unit he was attached, and what his rank was at that time. 8. If any of these officers have gone to the fighting front since May 1, state name, unit, rank and date.—(*The Senate.*)
Not printed.

263. Part return to an humble Address of the Senate to His Excellency the Governor General, dated the 8th instant, showing all the correspondence between the Department of Militia and Defence and Clarence J. McCuaig; also, between the same and the first Purchasing Committee appointed by Sir Robert Borden, of which the Honourable Robert Rogers was Chairman, and between the said Clarence J. McCuaig and the Committee of which the Honourable Sir Edward Kemp is or was Chairman, or with any of the members of the said committee.—(*The Senate.*).. .. ..*Not printed.*

264. Eighth Annual Report of the Commission of Conservation for the fiscal year ending 31st March, 1917. Presented by Hon. Mr. Burrell, September 1, 1917.. .. .. ..*Not printed.*

265. Return to an Order of the House of the 30th August, 1917, for a return showing:—1. The number of additional buildings and offices that have been rented by the various departments of the Government in the City of Ottawa during the calendar years, 1914, 1915, 1916 and 1917. 2. The names of the lessors, the length of the lease and the respective rentals of said buildings. 3. What department in each case is occupying said premises. Presented September 3, 1917.—*Mr. Sinclair*.. .. ..*Not printed.*

CONTENTS OF VOLUME 21—*Continued.*

266. Return to an Order of the House of the 11th July, 1917, fo a copy of all correspondence and other documents relating to the granting to beam trawlers registered in the United States the privilege of using ports in the Province of Nova Scotia for the purchasing of supplies, the shipping of men, etc., without license therefor as required under the modus videndi. Presented September 3, 1917.—*Mr. Kyte*.. .. ..*Not printed.*

267. Copy of contract dated 8th March, 1917, between His Majesty the King and Wallace Shipyards, Limited, for the construction and delivery of one wooden auxiliary sailing ship. Also,—Copy of contract dated 1st June, 1917, between His Majesty the King and Lamond and Harrison for the construction and delivery of one wooden auxiliary sailing ship. Presented by Hon. Mr. Cochrane, September 3, 1917.. .. ..*Not printed.*

268. Return to an Order of the Senate, dated the 15th day of June last, for a return made to an Order of the House of Commons, of the 7th February, 1916, for a copy of all correspondence and reports on the claims of Sealers of British Columbia under the last treaty with the American Republic, and all papers connected therewith.—(*The Senate.*) *Not printed.*

269. Copy of Order in Council, P.C. 2245, dated 3rd September, 1917, appointing the Deputy Minister of Justice, Oliver Mowat Biggar, of the City of Edmonton, John H. Moss, of the City of Toronto, Louis Loranger, of the City of Montreal, and Lt.-Col. H. A. C. Machin, of the Town of Kenora, Ont., a council to advise and assist in the administration and enforcement of the Military Service Act, 1917, to be known as the Military Service Council. Presented by Sir Robert Borden, September 4, 1917.. ..*Not printed.*

270. Return to an Order of the House of the 21st May, 1917, for a copy of all reports, letters, telegrams, correspondence and any other papers in connection with the question of locating the 210th Battalion at Regina and Moosejaw respectively during the winter of 1916-17. Presented September 6, 1917.—*Mr. Knowles*.. .. . .*Not printed.*

271. Return to an Order of the House of the 14th May, 1917, for a copy of all letters, correspondence, telegrams and reports received by the Government since September, 1911, to the present day, in any way referring to the appointment of a man in charge of the storm signals at Grand Etang and Margaree Harbour. Presented September 6, 1917.—*Mr. Chisholm*.. .. ..*Not printed.*

272. Return to an Order of the House of the 7th May, 1917, for a return showing the different rural mail routes established in the constituency of Qu'Appelle since the 1st day of January, 1916, showing their location and date of establishment. Also, a list of all rural mail routes now being established or under consideration at the present time in the same constituency. Presented September 7, 1917.—*Mr. Thomson* (*Qu'Appelle*). *Not printed.*

273. Return to an Order of the House of the 6th March, 1916, for a copy of all telegrams, letters, petitions and documents of all kinds in any way referring to the change in the Inverness-Margaree mail route from the west to the east of the Margaree river, from a point at Margaree Forks to Chapel Bridge. Presented September 7, 1917.—*Mr. Chisholm*.. .. ..*Not printed.*

274. Copy of Order in Council, P.C. 2199, dated 10th August, 1917: Rules and Regulations enacted in lieu of the Classification, Rules and Regulations contained in Order in Council, P.C. 1296, of the 15th May, 1917, in respect to War badges for members of the Canadian Expeditionary Force. Presented by Sir Edward Kemp, September 13, 1917. *Not printed.*

275. Copy of Order in Council, P.C. 2552, dated 13th September, 1917, recommending that Certificates of Naturalization may be issued under the Naturalization Act, 1914, to alien enemies who have resided for many years in Canada, on its being shown that they are clearly in sympathy with the United Kingdom and its allies in the present war, and that they have no pro-German or other alien enemy affiliations or connections. Presented by Sir Robert Borden, September 14, 1917.. .. ..*Not printed.*

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276. Copy of *Canada Gazette* dated 12th September, 1917, containing a list and location of Local Tribunals established to hear and decide applications for certificates of exemption from Military Service. Presented by Hon. Mr. Doherty, September 14, 1917.
Not printed.

277. Copies of Orders in Council, dated 15th September and 17th September, 1917, respectively, appointing Registrars for the Provinces of British Columbia, New Brunswick, Quebec, Saskatchewan, Manitoba, Ontario, Alberta and Prince Edward Island, under the provisions and for the purposes of the Military Service Act, 1917. Presented by Sir Robert Borden, September 17, 1917.. .. ..*Not printed.*

278. Return to an Address to His Excellency the Governor General of the 2nd May, 1917, for a copy of all Orders in Council, letters, telegrams, etc., to or from any employee of the Government in reference to the improvement and equipment of the life-saving station at Whitehead, Guysborough County, N.S. Presented September 17, 1917.—*Mr. Maclean (Halifax)*.. .. ..*Not printed.*

279. Return to an Order of the House of the 14th May, 1917, for a copy of all letters, petitions, correspondence, telegrams and reports received by the Government since September, 1911, to the present day, in any way referring to the dredging and building of piers at Mabou Harbour. Presented September 19, 1917.—*Mr. Maclean (Halifax)*.
Not printed.

280. Return to an Order of the House of the 13th August, 1917, for a return showing:—1. The different amounts paid for commissions and expenses in connection with the flotation of the different loans made by Canada since 1914. 2. The respective amounts paid in connection with each loan. Presented September 19, 1917—*Mr. Macdonald.*
Not printed.

281. Return to an Order of the House of the 5th September, 1917, for a copy of all correspondence, letters, telegrams, petitions, etc., in any way referring to an application for a public wharf at Chimney Corners, Inverness County, N.S. Presented September 19, 1917.—*Mr. Chisholm*.. .. ..*Not printed.*

282. Return to an Order of the House of the 29th August, 1917, for a return showing copies of all accounts, memoranda, vouchers, telegrams, letters, etc,, in reference to payments to George H. Boyce, of Windsor, N.S., District Foreman of Public Works Department, since his appointment to office. Presented September 19, 1917.—*Mr. Maclean (Halifax)*.
Not printed.

283. Return to an Order of the Senate dated the 1st day of March, 1916, showing a copy of all correspondence between the Government and the British Columbia Boards of Trade, and also between the Government and the Canadian Manufacturers' Association, in reference to the request made by the British Columbia Boards of Trade for the appointment of a Dominion Customs Officer at the Port of New York.—(*Senate.*).
Not printed.

284. Part return to an humble Address of the Senate, dated the 14th of August, 1917, to His Excellency the Governor General, for a return showing the name of every judge of the Supreme, District and County Courts in all the provinces of Canada, for the year 1916, together with a statement of the moneys paid to each of such judges for that year for (*a*) salaries; (*b*) travelling expenses; (*c*) allowances of all kinds; (*d*) for services as Commissioners; (*e*) and any other payments; and also, showing the names of judges who have performed services as Commissioners, or in any other public capacity without compensation.—(*Senate.*).. .. ..*Not printed.*

285. Return to an humble Address of the Senate, dated the 9th August, 1917, to His Excellency the Governor General, showing all the documents relating to the purchase by the Militia Department of "Bonnie Bel Air" from W. T. Rodden, Esq., a part of number nine (9) on the official plan and book of reference of the Parish of Lachine and specially the report of the lawyers who examined the titles.—(*Senate.*).. ..*Not printed.*

DEPARTMENT OF THE INTERIOR

ANNUAL REPORT

OF THE

TOPOGRAPHICAL SURVEYS BRANCH

1915-16

PRINTED BY ORDER OF PARLIAMENT.

OTTAWA
PRINTED BY J. DE L. TACHÉ,
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1917

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2. Map showing topography and profiles of base lines and meridians run during the year.

REPORT

OF THE

SURVEYOR GENERAL OF DOMINION LANDS

The amount appropriated by Parliament for Dominion Lands surveys during the fiscal year 1915-16 was $1,043,500, practically equivalent to the appropriation of the previous year.

INITIAL MERIDIANS AND BASE LINES.

The initial meridians and the base lines, which are the governing lines of the whole system of Dominion Lands surveys, have been established so far beyond settlement that their further extension has ceased to be very urgent, and the number of parties engaged on that work could be reduced to six. They surveyed 962 miles.

A record was made in producing the Sixth meridian two miles into township 127, which is also two miles beyond the northern boundary of Alberta, the farthest point north reached by the Dominion Lands system. This brings Dominion Lands surveys 763 miles north of the international boundary. In the other direction, they stretch in an unbroken network from tide water on Hudson bay at Port Nelson to tide water on the Pacific at Burrard inlet and Semiamu bay, nearly 1,400 miles.

Although far north, good farming country was found on the Sixth meridian. Keg River trading post is in the centre of a beautiful prairie consisting of several townships of good agricultural country. Good stretches exist also along Battle river. North of township 120 are the Cut Knife mountains, the soil of which, under its coating of deep moss and stunted spruce, remains frozen throughout the summer.

Good country was found on the Wabiskaw between Peace river and the Fifth meridian, but it is difficult of access at present.

East of lake Winnipegosis and south of Saskatchewan river is a stretch which the surveyor describes as the finest agricultural land he has seen in northern Manitoba.

Elsewhere, the surveys of base lines and meridians have not disclosed much land of value. The country has been explored for twelve miles on each side of the line surveyed and the information obtained is shown on the exploration maps appended to this report.

TOWNSHIP SUBDIVISION.

The regular township subdivision surveys have hitherto been performed under contract, at certain rates per mile fixed from time to time by the Governor in Council. The method has proved most unsatisfactory.

In 1913 it was recommended that the contract method be abandoned and that in future the subdivision of townships be executed by surveyors and parties paid by the day. The arguments in support of this recommendation were as follows:—

1. The system of Dominion Lands surveys is an adaption of the United States system. The method of surveying under contract was one of the features borrowed from the United States; it had several advantages, and as land had little value, it was believed that the imperfection of the surveys was of small consequence. The system was cheap, and as little or no inspection was made, it gave no trouble for the time being. Surveyors were ready to undertake surveys for almost any remuneration. At one time, tenders were called: the rates asked by the surveyors were so absurdly low that they have since been fixed by Order in Council at a figure sufficient for doing the work irrespective of what the surveyors would be ready to accept. A consideration which had great weight when a rush of immigration set in was that the amount of surveying which could be performed under the contract system was unlimited. With work paid by the day, the amount was limited by the number of qualified surveyors available: there was no such limitation with contractors.

2. The objections to surveys made under contract are many. The cost of a subdivision survey cannot be estimated in advance; it depends upon the nature of the ground and upon other circumstances unknown both to the Government and to the contractor, and which cannot be foreseen. No schedule of rates can be devised which will afford fair remuneration to the contractor in all cases without being excessive in any case. A contractor may make large profits if he happens to strike good country and is favoured by circumstances, while another may lose money through no fault of his own if circumstances are against him. If he is unable to pay the wages of his men or his bills for supplies, the creditors ask payment from the Government and are aggrieved when it is refused.

3. Before a contractor is paid for a survey, some one should go over the lines in order to make sure that the survey for which payment is asked has actually been made. This inspection is never made for the obvious reason that it costs as much to inspect a survey line as to survey it in the first instance, the inspection involving the same measurements as the survey itself. If all the lines were inspected, the inspector might as well survey them himself and dispense with the survey of the contractor, thus saving the cost of the contract.

In the early days, very little inspection was made: the word of the contractor that the survey had been correctly executed was accepted and he was paid. We are now going over these old surveys; many of them are incorrect. Sometimes we can find no trace of a survey, and it is a question whether the original survey, which was paid for, was ever made.

4. At present, an inspection is made of a few miles in each contract. If nothing wrong is found, it is assumed that the remainder of the contract has been executed and that the survey is correct, but there is no direct evidence that such is the case.

5. There are five inspectors and a chief inspector of surveys; the cost of inspection is over $68,000 a year. The expenditure on contract surveys this year is $240,000, so that the inspection costs more than one-quarter of the work inspected. It is true that the inspectors do some little work besides inspection, but it does not amount to much.

6. Some surveyors do good work under contract; others do not. When a contractor's work is found defective, he is invited to correct it. He corrects the defects pointed out by the inspector, after which a new inspection is made and new defects are discovered. This may happen again and again until so many inspections are made that it would have been cheaper for the inspector to make a new survey.

7. When the survey is very bad, the situation is most embarrassing. The bond given by private sureties for securing the advances does not appear to have much value; we have lost the cases that were brought before the courts. Surety companies are the only ones from whom we have recovered because they prefer paying to being sued by the Government. Practically we have the alternative of accepting bad work or losing our advances.

8. A large proportion of the appropriation for Dominion Lands surveys is now being expended in resurveying townships imperfectly subdivided under contract. The lands being settled and occupied, the resurveys are very intricate, unsatisfactory to the settlers, and most expensive. Money would have been saved if the surveys had been properly made in the first instance. For this reason alone, if for no other, the contract system should be abolished.

9. Land has become too valuable for the imperfections of the contract system. The value of one or two acres in a quarter-section represents many times the difference in cost between a good and a bad survey.

10. After he has finished the survey in the field and received 75 per cent of the amount of the contract, the contractor attends to the preparation and correction of his field notes when he is not otherwise engaged. This is the cause of serious delays: it is seldom less than two years before the township plans are issued and the lands thrown open to settlers.

11. With competent surveyors and properly organized parties, there is no reason why subdivision surveys paid for by the day should cost much more than if executed under contract.

12. The contract system was discarded in 1910 by the United States. The last report of the Commissioner of the General Land Office contains the following remarks:

> "June 30, 1911, was the close of the first fiscal year under the direct system, and it is gratifying to be able to report that it has been an unqualified success. When the change in method from the contract to the direct system was first considered, it was expected that the cost of production would not be greater than that in the procedure which it was proposed to abandon. It was conceded that greater expedition would ensue and better work be accomplished, and this alone would have justified the change. The work of last season and this season, however, has shown that the average cost of survey of a township under the direct system is $750, or a saving of about $5 per mile, the average cost of surveys under the contract system being $15 per mile. . . . . There is, in addition, a saving of from one to two years in time, counting from the time of the appropriation to the completion and adoption of the survey."

Before finally adopting the recommendation to perform subdivision by day work, it was decided to give the new method a trial. This was done with one party in 1914, and the experiment proved so encouraging that the method was adopted for all regular subdivision surveys in 1915. The result has been an unqualified success. The work accomplished and net cost per mile, which are given below, are obtained by deducting from the total expenditure of each surveyor the value of the outfit remaining on hand at the end of the season. Four of the surveyors took levels, which was not done under the contract method; the cost of the levels was also deducted from the total expenditure.

REGULAR TOWNSHIP SUBDIVISION—1915.

Surveyor.	Miles.	Total expenditure.	Value of outfit.	Cost of levels.	Net cost.	Cost per mile.
		$	$	$	$	$ cts.
Baker, J. C.	471	16,170	469	.....	15,701	33 33
Buchanan, J. A.	412	14,816	606	.....	14,210	34 49
Christie, W.	454	10,759	352	765	9,642	21 23
Davies, T. A.	345	14,237	952	.....	13,285	38 50
Day, H. S.	344	14,850	349	.....	14,501	42 15
Fawcett, S. D.	409	15,377	889	.....	14,488	35 42
Glover, A. E.	404	14,906	480	.....	14,426	35 70
Heathcott, R. V.	455	14,993	690	.....	14,303	31 43
Johnston, J. H.	460	14,789	300	885	13,604	29 57
Knight, R. H.	381	14,965	696	.....	14,269	37 45
Lighthall, A.	511	14,766	875	945	12,946	25 33
McEwen, D. F.	562	13,937	542	.....	13,395	23 83
Pearson, H. E.	502	13,757	479	.....	13,278	26 45
Pierce, J. W.	628	17,419	788	.....	16,631	26 48
Rolfson, O.	558	13,399	325	.....	13,074	23 43
Scott, W. A.	470	14,286	398	790	13,098	27 87
Tipper, G. A.	375	15,116	659	.....	14,457	38 55
Tyrrell, J. W.	423	10,946	362	.....	10,584	25 02
Waddell, W. H.	448	*15,000	300	.....	14,700	32 81
	8,612	274,488	10,511	3,385	260,592	30 26

*Estimate only—Accounts and returns not in yet.

The comparison between subdivision under contract in 1914 and subdivision by day work in 1915, is given below:—

Year.	Method.	No. of parties.	Miles surveyed.	Total cost.	Cost per mile.
1914	Contract....	18	7,686	$ 229,303	$ 29 83
1915	Day Work..	19	8,612	260,592	30 26

The cost per mile of day work is 43 cents more than contract work, less than one and a half per cent, but an examination of the table for 1915 shows that the average cost of day work is considerably increased by the high individual cost of three surveyors. By placing in charge of subdivision surveys those surveyors only who have made a success of this kind of work, as has been done in 1916, the cost will be substantially less than under contract. It must be recognized, however, that day work is possible only so long as surveyors are left free to select and engage their own labour, without any interference. The advantage of the surveyor on salary over the contractor is that he has better credit. His men know that their wages will be paid when due, and a merchant, if not paid cash, knows that he has not long to wait for his money. It is not so with contractors; when they do not fail, leaving their creditors unpaid, they are generally slow in paying, and are accordingly charged higher rates.

At the inception of Dominion Lands surveys, a road 99 feet wide was laid out on every section line, and marked on the ground by the surveyor. This is what is called the first system of survey. Later, the width of the roads was reduced to 66 feet, and every alternate road running east and west was suppressed. This is the third system

of survey, which extends over the greater part of the country. In subdividing a township of the third system, the surveyor marked only those section lines along which were the roads, the section lines without roads, the "blind lines," remaining unsurveyed. This is a great handicap to the new settler: to find the limits of his quarter-section, he has first to locate the quarter-section corner on the blind line, and this, especially in wooded country, is more than an ordinary farmer can manage. The procedure has now been changed, and in subdividing a township all section lines are surveyed and marked on the ground, whether the township is of the first or of any other system. The change is one which will be thoroughly appreciated by new settlers.

TOWNSHIPS SUBDIVIDED.

Most of the townships subdivided are in the Peace River district. The construction of railways to Spirit River and Peace River Crossing has made the country easily accessible, and turned the flow of new settlers in that direction. The survey parties were spread along Peace river from Fort St. John in British Columbia, to below Fort Vermilion. Others were south and east of Lesser Slave lake and on Athabaska river below McMurray. The land immediately adjoining the Alberta and Great Waterways railway between Lac La Biche and McMurray was laid out into sections. Although little of it is adapted to farming, some pieces will be taken up and the railway itself will require grants.

In addition to the nineteen parties engaged on regular subdivision work, twelve parties were employed on miscellaneous and scattered subdivision at various points in Manitoba, Saskatchewan, and Alberta. Seven parties were working in the railway belt of British Columbia. In the western part of the belt, the land, which is very valuable, is disposed of in quarter quarter-sections, or legal subdivisions, of forty acres, the corners of which have to be marked by boundary monuments. This not only increases the work on the survey line but also the number of lines to be surveyed, and with the heavy timber contributes to make the surveys in that section of the country exceedingly expensive.

INSPECTION.

The system of inspection has been modified to adjust it to the new conditions of subdivision surveys. The camps of most surveyors were visited, the work examined, and a report made upon the organization and equipment of the parties. Three inspectors were employed on this work, and in addition the Chief Inspector of Surveys spent five weeks in the field.

When not otherwise engaged, the inspectors occupy their time on miscellaneous surveys.

WATER AREAS.

Many of the bodies of water which existed at the time of the original survey have since partially or wholly dried up, leaving their beds available for cultivation. Twelve parties were employed in making a new survey of these areas. The surveyor's instructions are to make a thorough investigation of each township, to survey every body of water found in it and to obtain all the information necessary for the preparation of new township plans representing actual conditions. He is also directed to report upon the condition of the boundary monuments in the township, and any other feature of the township survey. Occasionally he may, where necessary, erect or restore a few boundary monuments, but his party being small, work of this nature is preferably allotted to larger parties.

The twelve parties investigated 734 townships. They surveyed 5,007 miles for the water areas, and resurveyed 762 of section lines. The table below gives a synopsis of their work.

STADIA SURVEYS.

Surveyor.	Water areas miles.	Re-survey miles.	Total mile-age.	No. of town-ships.	No. of lakes.	Total cost.	Cost per mile.	Cost per town-ship.	Cost per lake.
						$	$ cts.	$ cts.	$ cts.
McKnight, J. H.	577	8	585	31	216	5,479	9 37	176 74	25 37
Boulton, W. J.	564	12	576	39	134	5,067	8 79	129 92	37 80
Neelands, R.	526	129	655	50	263	5,116	7 80	102 32	19 45
Soars, H. M. R.	523	2	525	45	276	5,387	10 26	119 71	19 52
Fletcher, W. A.	484	62	546	27	349	4,946	9 05	183 18	14 17
Martindale, E. S.	294	20	469	59	147	3,618	12 02	67 12	24 51
Coltham, G. W.	155			25	83	2,020			
Cowper, G. C.	294	84	378	81	87	5,313	14 06	65 59	61 07
Bowman, E. P.	440	34	474	54	238	5,695	12 02	105 46	23 93
Roberts, O. B.	390	92	482	76	183	5,642	11 70	74 24	30 83
Bennett, G. A.	340	131	471	75	176	5,514	11 71	73 52	31 33
Palmer, P. E.	238	75	313	64	244	5,193	16 59	81 14	21 28
Rinfret, C.	182	113	295	108	125	4,642	15 73	42 98	37 14
	5,007	762	5,769	734	2,521	63,632	11 03	86 69	25 24

ALBERTA-BRITISH COLUMBIA BOUNDARY.

From the international boundary to the 120th degree of longitude, the boundary between British Columbia and Alberta is the continental divide. The location of this boundary, commenced in 1913, was continued. The two provinces and the Dominion pay each one-third of the cost. R. W. Cautley, D.L.S. and A.L.S., is commissioner for the Dominion and Alberta. A. O. Wheeler, B.C.L.S., is commissioner for British Columbia. Mr. Cautley locates and marks the boundary in the passes; Mr. Wheeler makes a topographical survey of the boundary in and between the passes. About twelve miles of line was delimitated in the passes and twenty-six boundary monuments erected. All work so far has been south of the Kicking Horse pass, the passes marked last season being the Akamina, Elk, Dome, and North Fork.

TOPOGRAPHICAL SURVEY.

With the exception of Mr. Wheeler's survey of the interprovincial boundary, the only topographical work was a survey of Jasper park. The season was not favourable; of 114 days, only 48 were fine, and even then the work was often retarded by haze or cloud shadows.

SETTLEMENTS AND TOWNSITES.

A number of small settlements and townsites, principally in Manitoba, were surveyed. River lots were laid out on Carrot river, and at Grand Rapids on Saskatchewan river in Manitoba. The St. Julien addition to the townsite of Banff was surveyed on Tunnel mountain.

TIMBER BERTHS AND MINERAL CLAIMS.

Two timber berths with eleven miles of boundaries were surveyed.

Every mineral claim is designated by a lot number in the group to which it belongs. Before the issue of the patent for the claim, the regulations require a survey under instructions of the Surveyor General. Twenty-nine of these claims were surveyed.

YUKON SURVEYS.

The Surveyor General is represented in the Yukon Territory by a Director of Surveys, assisted by one draughtsman. According to the director's report, which is appended, the returns of fourteen surveys were filed in his office. These consisted of Indian reserves, road traverses, and surveys in connection with mining claims.

RESURVEYS.

The evils of the slovenly surveys executed under the contract system in the early days are coming home now that the land is being settled. They are of two kinds; inaccuracy of the survey and lack of permanency of the boundary monuments. At that time land had little value, and any kind of survey was considered good enough. Inaccuracy is obnoxious, but the greatest trouble is caused by the loss of boundary monuments. At first wooden posts were used, as they had been in the eastern provinces, but the conditions were quite different. In the East these posts were made of durable wood, and the lines blazed in timber remained visible for a long time; in the West the posts were of poplar, a kind of wood which decays quickly, and where lines were blazed in the woods, the timber was so light that a single fire obliterated it. In the eighties, a piece of small gas pipe was substituted in the place of the wooden post, but it was easily pulled out and many have disappeared.

A new style of post has now been adopted. It consists of a one-inch iron pipe thirty inches long and filled with concrete. A malleable iron foot-plate prevents the removal of the post after it has been planted. The numbers of the section, township, and range are stamped in plain figures on a bronze cap, and the inscription can be understood by anybody. The adoption of this new post is the most important step that has yet been taken for the improvement of the surveys of the Dominion Lands. The two principal needs of a land owner are the security of his title and the security of his boundaries. His title is looked after by the Lands Titles Offices. The security of his boundaries depends upon the permanency of the boundary monuments; so long as they are in evidence, there is no room for dispute between himself and his neighbours.

To a person not conversant with surveying, the loss of a boundary monument may appear to be a matter of no great consequence, involving nothing more than the erection of a new monument, but that is very far from being the case. If the land is settled, vested rights intervene, and it is only in sparsely settled places that after a great deal of trouble, new monuments can be erected to which no one will object. In townships where any considerable proportion of the land is patented, any attempt to resurvey the lines is almost sure to prove a failure, and the only course open to the owners is to bring their disputes before the courts for adjudication.

Another source of trouble is the existence of several monuments to mark one corner; sometimes, but not always, the difficulty can be adjusted.

The Dominion Lands Surveys Act authorizes the Minister to have a resurvey made of a township on receipt of a petition stating that the monuments have disappeared and cannot be found. The same provision has been enacted as a provincial statute by the legislatures of Saskatchewan and Alberta, but not by Manitoba. Under this arrangement, it has been found possible to make resurveys which will hold good in law, in townships where the amount of lands alienated is small. Of course, the work is very expensive.

Five parties were engaged on this work. They resurveyed wholly or partially thirty-five townships and the settlement of Lac la Biche. In addition, small resurveys were made at a number of places by the same surveyors.

Errors in surveys, are more difficult to correct. In old times, it was contended that a farmer whose patent calls for 160 acres, but whose quarter-section contains only 120, is just as contented as if he had 160 acres so long as he is not made aware of the shortage. In the first Dominion Lands Act, the contents of a quarter-section were

declared to be 160 acres, whatever the actual contents might be. There may be some merit in this view when the discrepancy is small, but when it is large there cannot be two opinioins as to the duty of the administration to correct the error, if it can be done. The difficulty is that when a man has a grant from the Crown, no one has the right to displace his boundaries, whether they are in error or not. Three surveyors were engaged in work of that nature, and in adjusting difficulties of all kinds. They visited about eighty townships in all. Sometimes they were successful and sometimes they were not.

Unlike township subdivision, the initial meridians and base lines have, fortunately, for the last thirty-six years, always been surveyed with care by day work, and the result, taken as a whole, is remarkably accurate; but with the perfection of our organization and methods, we now discover discrepancies which, although individually small, assume material proportions by accumulation over the immense area covered by Dominion Lands surveys. In expanding the system, it is necessary to know the exact size and location of the discrepancies so that they may be allowed for in the expansion. For this purpose, one party retraced 677 miles of base lines and initial meridians. Advantage was taken of his survey to level the lines retraced.

Another method of adjusting the discrepancies of governing lines is by means of astronomical observations. One surveyor made determinations of the latitude with a zenith telescope at a number of points, mostly in Manitoba and Saskatchewan. Each point of observation was connected by measurement with some corner monument of the Dominion Lands system.

STATEMENT OF MILEAGE SURVEYED.

The following is a comparison of the mileage surveyed each year since 1913:—

Nature of Survey.	April 1, 1913, to March 31, 1914.	April 1, 1914, to March 31, 1915.	April 1, 1915, to March 31, 1916.
	Miles.	Miles.	Miles.
Township outlines	3,760	3,270	2,725
Section lines	7,918	7,100	7,524
Traverse	5,748	5,141	7,234
Resurvey	1,632	2,544	3,441
Total for season	19,058	18,055	20,924
Number of parties	66	59	53
Average miles per party	289	307	395

Owing to the nature of their work twelve parties are not included in this year's statement. The surveys of the fifty-three parties cost $628,815, or $30.05 per mile.

OFFICE WORK.

DIVISION OF SURVEY INSTRUCTIONS AND GENERAL INFORMATION.

The work performed by this division consists, in general, of the preparation of instructions for the surveyors who are engaged in the field operations, the entering of all survey returns in the various registers, the issuing of all preliminary plans, the answering of requests for information received from the general public and from other branches and departments, and the issuing of the annual report of the branch.

The preparation of instructions for the surveyors in charge of parties in the field is perhaps the most important work of the division. Greater accuracy and precision in the surveys is being constantly demanded, and this necessitates more work and greater care, in the issuing of instructions as well as in the performance of the surveys and the examination of the returns. The preparation of instructions for any particular survey involves the collection of a great deal of information about the surveys which have already been made in the vicinity, the nature of the country, the roads and trails, the best means of transportation, etc. Plans and sketches must also be prepared to accompany the instructions, showing all information about the section lines already surveyed, as well as about any Indian reserves, townsites, settlements, forest reserves, etc., which are located in the townships to be surveyed.

Another important part of the work is the dealing with communications from settlers and others, and the answering of inquiries about surveys from other branches and departments. This involves the preparation of a large number of sketches, tracings and maps and the copying of many pages of field notes. As part of this work, the distribution is carried on of all the publications issued by this branch, including plans, maps, reports, and pamphlets. The number of sectional maps alone which are sent out amounts to many thousands.

As a rule the writing of descriptions for insertion in the patents for all regular parcels of land is done in the Lands Patents Branch of the department. In all cases, however, except for mineral claims, where the parcel is very irregular and the description is complicated and difficult, the description is prepared in this division.

During the period the surveyor is in the field he is required to furnish sketches from time to time showing the progress of his work. From these sketches preliminary plans of the townships are issued in order that the lands may be opened for entry at once without waiting for the examination of the surveyor's final returns and the issue of the official plans. Four copies of each plan are required for the townships in Manitoba, Saskatchewan and Alberta, and six copies each for the townships in the railway belt of British Columbia.

In this division all returns of survey are received, including plans and field notes of township, settlement, and miscellaneous surveys, of levelling operations and of the survey of timber berths, mineral claims, and rights of way. These returns are entered up in the various registers and on maps, a record being kept of the surveys performed each year by each surveyor and of the progress of each surveyor's work in the field. When the examination of the plans and field notes have been completed they are sent to the Survey Records Branch to be placed on record.

The preparation of the third edition of the pamphlet entitled "Description of the surveyed townships in the Peace River district in the provinces of Alberta and British Columbia" was commenced during the year 1914-15. The war, however, caused a decided falling-off in the number of requests for the report and, in consequence, it was decided to postpone the issue for the time. The work of preparation was again taken up during the latter part of the past year, and it is expected that the new edition will be issued in two or three months.

The topographical surveys in connection with townsite subdivision which were commenced in 1912 were again carried on during the year. Surveys were made of a subdivision known as the St. Julien addition to the town of Banff, containing an area of about 100 acres on the southwest slope of Tunnel mountain. As the plan of this area prepared last year did not show the topography in sufficient detail for laying out the subdivision further levels had to be taken and a new topographical map prepared. From this map a scheme of subdivision was laid out. Plans of the blocks on a scale of twenty feet to an inch were made and from these all the information necessary for the execution of the survey was calculated. On completion of the survey the surveyor's returns were examined and a plan of the subdivision was compiled for publication. It is expected that this plan will be issued shortly.

A new feature of the work of the division is the examination of plans showing rights of way for irrigation ditches or works to accompany the licenses of occupation which are granted in such cases. In the past the Irrigation Branch has had difficulty in some cases in registering the licenses of occupation in the Land Titles Offices because of lack of information or errors in the plans submitted. It was with a view to obviating this difficulty that the Superintendent of Irrigation requested that the examination of these plans be undertaken by this branch. The plans are not approved, as most of them have been prepared from surveys made by the engineers of the Irrigation Branch and not by qualified surveyors. Suggestions are merely made in regard to the points in which the plans are considered defective. The various suggestions which have been offered have now been incorporated in the instructions issued by the Irrigation Branch for the preparation of right of way plans. This examination involves considerable work as some of the plans are complicated and in many cases have to be re-examined.

DIVISION OF EXAMINATION OF SURVEYS.

The work of this division comprises the examination of the returns of survey of all Dominion Lands except subdivision in the railway belt in British Columbia, together with the preparation of all official plans thereof; it includes the examination of all surveys of mineral claims, and of all plans of railways and provincial roads.

The work begins with the receipt of the field notes of survey and other final returns, and ends when these have been examined and the required corrections obtained, the official plans prepared and the final returns have been sent to the Survey Records Branch. The bulk of the field notes are received during the last four months of the fiscal year, and are dealt with during the subsequent year.

Before subdivision can be undertaken it is necessary to extend a framework of precise surveys of meridians and base lines as a control, but no official township plans are made until some subdivision has been done. The cessation of contract surveys has not greatly affected the work, as the contracts of the preceding year were on hand. This work has all been completed and the remaining twenty-nine contract accounts closed.

The first returns received from the surveyor in the field are sketches showing the progress of his work. These are examined to see that correct methods are being employed and that satisfactory results are being obtained. Nearly 1,300 of these sketches are received during the field season.

The twelve surveyors investigating former lake beds and traversing lakes in the older parts of the western provinces are required to plot their surveys as fast as they are made, and to transmit their field notes and plots without delay to this office. These are examined to ensure their accuracy; the plots are combined by tracing into larger plans, which in turn are reduced by photography for the compilation of the new township plans.

An important change was made in the preparation of plans with the result that they now show in what year and by what surveyor each monument on the plan was erected or last renewed. This information requires considerable time to secure, but greatly adds to the value of the plans.

The compilation of a township plan comprises a great many operations. First, is the proper entry of the new survey in the records of the office; then, a cursory examination of the returns; then, the records are consulted for a complete list of former surveys affecting the township. When this has been done the new survey receives its final examination, and is combined with the former surveys on the new plan. If the examination reveals errors or discrepancies in the field notes, or other defects, these must be corrected before the plan can be completed. The new survey often reveals gross errors in the old that make it impossible to complete the plan before further surveys have been made on the ground. Plans of lakes and rivers

have to be reduced to the proper scale. A list of the lands that have been disposed of is obtained from the Patents Branch. When the plan has been compiled, the work is all carefully checked by another member of the staff, and is passed by each of two other members before being finally accepted. It is then sent to another division for copying. When this has been done it is returned for further checking of patented lands and for comparison of the copy, after which it is ready to be photo-zinco-graphed for the printing press. Plans to the number of 950 were prepared.

With regard to the maps of the Yukon Territory, considerable progress has been made in completing plans that were begun in the preceding year. Practically all the Stewart river basin to the south and east of Dawson has now been covered.

Besides the subdivision of land, the examination of surveys comprises many other important branches of work including the Alberta-British Columbia boundary, the Government inspection of surveys and surveying parties, the writing of descriptions of mineral claims for transfer to the Province of British Columbia, the examination of plans of new roads and road diversions surveyed by the western provinces across Dominion Lands and of plans of railway right of way across Dominion Lands, and the answering of requests for information concerning surveys from other branches of the department and from the general public.

DRAFTING AND PRINTING DIVISION.

Township Plans.

The preparation for printing of plans of townships still constitutes the most important work of this division, and takes up a large part of the time. The method of printing has not changed materially since the old style of coloured plans was discarded, and the present plan in black and white adopted. However, frequent minor changes have been made from time to time in the amount and character of the data shown on the plans, these changes usually being the result of changes either in the method of survey or in the manner of showing the data returned by the surveyor. The latest change of this character relates to the abbreviations describing monuments. This particular change is important to the drafting division inasmuch as it renders many of the old fair copies useless for printing new editions.

The stamping or typing of township plans is done largely by temporary men employed as required. At the outbreak of the war in August, 1914, several of these men went to the front, and from time to time others have enlisted until now five are away. The policy of the department has been to curtail expenditure and so the places of men absent from the above cause have not been filled. The results of this policy were not immediately apparent, but the work in arrears has been slowly but steadily accumulating. We have now 509 plans of townships in hand. During the year, 803 township plans have been prepared for printing.

Miscellaneous Surveys.—These plans include settlements, townsites, additions to townsites, subdivisions, mineral claims, timber berths, and plans of parcels of land for schoolsites, bridges, etc. Twenty-four such plans were prepared.

Surveyors' Sketch Maps.

The surveyors of base and meridian lines return exploratory sketches of the territory adjoining their lines. These are printed on a scale of 12·5 miles to an inch, with a profile of the line having a vertical scale of 2,000 feet to an inch. Formerly the character of the soil and vegetation was shown by verbal descriptions written on the map across the area described. An attempt is now being made to show this information by colours or by symbols, the general principle being to show

the soil (including the state of the soil, i.e., whether wet, swampy or dry) by flat tints of colour, and to show the vegetation such as trees, grass or scrub by different symbols imposed upon the flat tints. These maps are issued with the report of the branch.

Miscellaneous Work.

Several important maps were drafted for printing. The first was a contour map of Jasper and vicinity to be printed in four sheets in four colours on a scale of 1:10,000, or 6·336 inches to a mile; the contour interval is 20 feet where slopes are steep and 10 feet in the more level portions. The map is now in the hands of the printers. The second is a somewhat similar map of the Crowsnest forest and Waterton Lakes park, Rocky Mountains forest reserve, in five sheets on a scale of 1:62,500, or 1·014 inches to a mile, with a contour interval of 100 feet. The black of both maps is engraved on copper, the other colours being printed from zinc plates made by photographing drawn copies. The second map is now in the hands of the engravers. Besides these, a number of miscellaneous jobs were done, including the preparation of plans to accompany orders in council, mounting maps and engrossing commissions and certificates for the Board of D.L.S. Examiners.

Sectional Maps.

The stock of sectional maps for distribution is in charge of this division, as the room in which they are stored is conveniently situated to the drafting room. The work consists in giving out the maps as required and in taking steps to see that the stock is reprinted before it is exhausted. As there are now 120 sectional maps printed in two weights of paper and on two scales, it requires care to see that the stock of each map is complete.

BRITISH COLUMBIA SURVEYS DIVISION.

The work of this division consists in the examination of surveyors' field notes and plots, the compilation of township, townsite, and miscellaneous plans, the comparison of the rough and fair copies of these plans and the replying to requests for various information.

Some of the field books, prepared during the last fiscal year for the use of surveyors in the railway belt, British Columbia, have been received, but at the close of the present fiscal year none of them had been examined, although a casual examination indicates that the time required will be greatly in excess of that necessary for the examination of the old field books.

The new system of compiling township plans, whereby the name of the surveyor is placed at each monument and an amended system of abbreviations used, necessitates the search of all field books appertaining to each plan, and entails, at a conservative estimate, five times the length of time for compiling that was required for the compilation of plans under the old system.

SECTIONAL MAP DIVISION.

The chief work of this division continues to be the compilation and revision of the sheets of the sectional map of western Canada. These "sectional maps," as they are briefly called, first received official mention in the Report of the Department of the Interior for 1892. The reference is on page 5 of the Report of the Surveyor General for that year, and is as follows:—

> "A record of all surveys made has hitherto been kept by compiling them on a scale of six miles to one inch on diagrams printed for the purpose; they exhibit at any time the state of the surveys in any part of the country. This

scale has been found too small for the many miscellaneous surveys executed lately, and a change has been made to two miles to one inch. From these diagrams, maps on a scale of three miles to one inch are reproduced by photo-lithography; the progress of settlement is shown by indicating with three different tints the lands patented, those entered, and those reserved for various purposes. Each sheet makes a map of convenient size, embracing a tract of land about fifty miles by eighty. Five have been issued; they are Edmonton, Peace Hills, Calgary, Prince Albert North, and Red Deer."

Each year since 1892 some new sheets have been compiled and printed, until now the total number is 120. These form an accurate and convenient series of maps covering the country from the lake of the Woods to the strait of Georgia and from the international boundary northward to Port Nelson and Fort Vermilion.

From the first the maps were printed on a scale of three miles to one inch and their purpose was to show in convenient form the progress of the surveys of Dominion Lands. Official surveys are still shown and may be considered to form the basis of the maps, but up-to-date information is also furnished in regard to railways and railway stations, post offices, Indian reserves, forest reserves, Dominion parks, roads and trails, road diversions, etc. Latitude and longitude are given to minutes, and altitudes are given in feet above sea-level. The maps are now printed in four colours. The sheets are numbered according to a regular system, and each sheet also has a name derived from some important city or town or from some prominent topographical feature within its boundaries.

Five new maps have been compiled covering territory recently reached by the Dominion Lands system, and twenty-three of the sheets previously issued were revised. Four others are in hand.

The work of compiling new sheets is done on printed projection forms on which township and section lines are shown in faint blue. The revision of old sheets is much facilitated by the use of white prints or photographic prints of the last edition, all changes and additions being shown thereon in red. These rough sheets when completed are checked and sent to the mapping room, where finished copies are made.

In addition to the work on sectional maps, considerable time has been spent on other work, as follows:—

(1) The township reports received from surveyors from July 1, 1914, to March 31, 1915, were prepared and printed in five pamphlets, and the reports for the year ended March 31, 1916, are well advanced.

(2) Work on the series of volumes in which it is intended to include all township reports received from surveyors from the beginning of the surveys, has been continued. Three volumes containing all reports on townships west of the Principal meridian were compiled and sent to the printer. Two of these, totalling 348 pages of printed matter, have been issued, and the third is being proof-read. One volume of reports on townships west of the Second meridian is ready for the printer, and another is in hand. Owing to the decrease in the staff, the work is not now being vigorously pushed.

(3) Sketch maps submitted by base line surveyors are now printed for the annual reports on a scale of 12½ miles to the inch. On this scale the necessary descriptive notes take up a large part of the space and render the maps very cumbrous and confusing. It was thought that the necessary information could be better conveyed by using flat tints to represent the different kinds of soil and timber, and after several attempts a scheme of colours and symbols was decided upon for these maps by which the amount of printed notes is reduced to a minimum. Nine sketch maps were worked out on this basis and accompany this report in monograph form.

(4) The township index map was revised. This is a map of western Canada on a scale of thirty-five miles to one inch, which is much in use in the department for showing the progress of the surveys and other information. The extension of the Dominion Lands system of surveys into the far north has given definite information as to the location of topographical features which had formerly been shown in approximate positions. Many errors were corrected, and the map was also brought up-to-date as regards railways, etc. The time of one man for a month was required in the revision.

(5) The method of obtaining the exact location of post offices and railroad stations, begun last year, has been continued. Of the 742 diagrams sent out to postmasters, 670 have been returned and the information plotted on the sectional maps.

The other work of the division is the making of clean manuscript copies, for photo-lithography, of the compiled and revised sectional maps.

Forty-six of the revised sheets and eleven new ones have been thus copied, but fourteen of the former and four of the latter are not yet printed.

A series of maps of the boundary between British Columbia and Alberta, as defined by the Interprovincial Boundary Commission are being prepared but are not yet completed.

SPECIAL SURVEYS DIVISION.

Base Line Surveys.

An examination of the returns of survey of all base lines and meridians is being made. The object of this work is to determine definitely the latitudes and longitudes of the monuments on the governing lines of the Dominion Lands surveys and, where possible, to correct the positions of any monuments originally established in error. For the requirements of the new surveys the determination of the latitudes of monuments already established has been more urgent than that of the longitudes and for this reason the greater proportion of this work so far has been given to determining their positions in latitude.

In conjunction with this work, two surveyors have been employed in the field, one in making retracements, and the other in taking latitude observations. Since 1910 latitude observations with the large zenith telescope have been taken at twenty-two points in the Dominion Lands surveys system. Of these, ten determinations were made in 1915. After being carefully checked over, the results of all the observations taken were applied to ascertaining the latitudes of monuments already established on base lines and meridians. In the application of these to the surveys it has been found that, in consequence of local attraction, a very appreciable difference exists at a number of the observation stations between the astronomic and the geodetic values for the latitude. It was therefore necessary to combine the results obtained at the various stations by connecting them by reliable survey lines, thus forming, as nearly as the accuracy of the line surveys will permit, a common datum to replace individual astronomic values. From this datum the latitudes of all other corners on base lines and meridians have been derived. In this way also it has been found possible to determine approximately the magnitude and direction of the local attraction at those latitude stations where the attraction is large. The accuracy of such determinations cannot be claimed to be closer than two chains. Owing to the great areas covered by the surveys, a limited number of latitude stations must necessarily be widely scattered, and the connecting line surveys over the long distances between stations have not the accuracy required for detecting the smaller local

attractions. At six stations out of twenty-two, differences of two chains or more in latitude have been caused thereby. The particulars of these are as follows:—

Location of latitude station.	Astronomic value of latitude.	Geodetic value of latitude.	Difference.
1. NE. cor. sec. 13, tp. 57–1–3.....	53°56′01″·77	53°55′59″·66	3·25 chains.
2. " 13, " 24–1–5.....	51°03′10″·94	51°03′09″·49	2·23 "
3. " 1, " 80–1–6.....	55°54′43″·13	55°54′47″·38	6·53 "
4. " 12, " 69–1–3.....	54°52′47″·21	54°52′43″·35	5·94 "
5. ¼ " 32, " 60–21–Pr.	54°14′25″·97	54°14′22″·26	5·70 "
6. NE. " 36, " 32–1–2.....	51°47′44″·99	51°47 43″·04	2·47 "

At the remaining sixteen stations smaller variations than two chains occur.

With the exception of a few lines in the vicinity of the Rocky mountains, and a few other lines which have been noted for retracement, the latitudes of all corners on base lines have been definitely determined. Plans have been prepared showing the positions of the monuments relatively to their theoretic positions, and also with respect to sea-level. This has entailed a very large amount of work. The returns of survey for over 20,000 miles of lines required examining, and to do this satisfactorily the records for as many more lines other than the governing lines for the purpose of providing checks on the work. Deflections in the lines were carefully calculated from the bearings returned in the field notes after the azimuth observations had been checked, and closings calculated and compared with computed theoretic values. From the returns of the levelling operations the elevations of the various lines above sea-level were ascertained, and for these elevations the required corrections to distances were computed and applied. On the older survey lines no levels had been taken, and information respecting elevations thereon had to be gathered from other sources. The required corrections, however, were in all cases applied. The corrected values for the various portions of all the lines were finally transferred to the plans being prepared and each base line given the latitude thereon which represents its actual position on the ground. When the first draft of the plans was completed the surprise came. The wonder is, not that some errors were found, but that the surveys fit together as well as they do, when the immense areas they cover are considered. Much work yet requires to be done before the longitudes of all corners are ascertained with the same accuracy as the latitudes.

Associated with the work of determining the latitudes and longitudes of monuments on base lines and meridians, is the work of determining the position of monuments erroneously established, registering the corrections required and by whom and when these corrections are made; computing closings and width of fractional ranges for new base lines to be surveyed; drafting instructions for the surveys of base lines, initial meridians, lines requiring retracement, and for the taking of latitude observations, and in general those matters relating to the control of the governing lines of the Dominion Lands surveys system.

Astronomical Work.

Azimuth Observations.—The observations for the azimuth of base lines and meridians surveyed during the season 1914-15 have been examined and have shown the same high degree of accuracy as those of the previous season. About twelve hundred observations were checked and the bearings of over twelve hundred miles of original line and a thousand miles of retracement survey were compared with these results. The field notes show a very small error to be left in the line, the mean

deviation from theoretic being less than six seconds; and as this error may be positive or negative the resultant error in the line is extremely small. The observations have been taken frequently enough to give good control of the line, the average distance between stations being less than five miles. While most of the surveyors follow the instructions in the Manual to observe every four miles or thereabouts, some have failed to observe with this frequency, thus bringing the average considerably above four miles. All follow fairly well the practice of taking two or more observations at a station. Deflections are seldom made on the strength of a single observation, and then only when weather conditions prevent the completion of a set. During the season only four such cases occurred. Other single observations were used merely as checks on other observations, or in cases where the conditions of running the line made it reasonably certain that the bearing was practically theoretic. The practice of taking single observations is not approved, as they give no idea of the accuracy of the observing and recording. When two or more observations are made at a station, the difference between the extreme values, that is the range of the results, is some indication of this accuracy. The average range for the season's work was less than ten seconds, and one observer had the remarkably low average of 4″·3.

In order to give the surveyor the benefit of criticisms suggested by his work, an effort is now made to have the observations checked and reported on before his return to the field for the next season. He can thus see in what respects his observing can be improved. Because of the reduced staff, only a small part of the work for the season 1915 has as yet been examined, but this portion shows the benefits of this course.

Latitude Observations.—One surveyor was engaged in latitude work and took ten observations with the zenith telescope. One on the Third meridian at township 68 was taken before the ice broke, and the others during the summer season. Of these, two were on the intersections of the Hudson Bay railway with the Principal meridian and the 16th base line west of the Principal meridian; four were in the vicinity of the Principal meridian in township 26, range 9, east, on the 5th base in range 7, east of the Principal, on the 8th base in range 5, east of the Principal, and on the 10th base in range 5, west of the Principal; three were on the 9th base at its intersections with the Second, Third, and Fourth meridians.

The Catalogue of Stars published by this office was used and proved a great convenience. It is mentioned in the introduction that the positions of the Ambronn stars are not considered as accurate as those of the other catalogues. This was clearly shown in the results of the latitude observations for this year. The average probable error of the first four observations, in which Ambronn stars were used, was ±0″·049, while that of the last six, in which they were not used, was ±0″·032. A similar improvement was shown in the probable error of a single observation due to observing and declination, which was ±0″·46 in the first four, and ±0″·29 in the last six. As the probable error due to observing alone is almost the same in both cases, this difference must be due to declination errors. Also, of the nineteen pairs rejected, two containing G5039 were rejected because of declination errors, three were observed under unfavourable conditions, and the other fourteen, consisting of eight different pairs, contained Ambronn stars. It is thus seen that the exclusion of Ambronn stars increases the accuracy of the results.

Astronomical Field Tables.—The Star tables for November and December, 1916, September and October, 1917, July and August, 1918, January, February, and March, 1917, and April, May and June, 1918, and the tables for the right ascension and the declination of the sun for 1917 have been compiled and printed. For the Star tables, owing to the continual motion of Polaris, it became necessary to compute new primary tables. These were type-written and then photographed on forms suitable for the computation of the field tables. The right ascension and the declination of the sun are now given in the same folder with a table for the sun's refraction and

parallax. This table is given with the apparent altitude as argument, and contains the combined amount of refraction and parallax, and the corrections to this for barometric pressure and temperature.

Magnetic Survey.

Sixty-two surveyors were instructed to observe for magnetic declination, and during the surveys made by R. C. Purser, D.L.S., and C. M. Walker, D.L.S., observations for magnetic dip and total force were taken at twenty-five stations. The results are given in Appendix 72. The instrumental constants of the dip circles as determined at Agincourt both at the beginning and end of the survey season show a probable error of less than 0.00010 c.g.s. in each case from the mean of at least six observations. At every station a complete observation for magnetic dip and total force, consisting of a dip, a total force and a dip, was taken. This observation was always duplicated and the average range found to be comparatively small.

The index correction to the compass of every transit used for observing was determined both at the beginning and end of the survey season. If the change was small the mean correction was used in the reduction of the observations. If a serious discrepancy was found between the two determinations it was investigated, and if the discrepancy could not be satisfactorily explained the observations taken with the instrument were rejected. Every observation for magnetic declination has been reduced, checked, and plotted on a large-scale map. They have been reduced to the mean of the month in which they were taken by means of the daily records of the declinometer at Agincourt, except those that were taken at times when the records were not observed. In the appendix such observations are marked with an asterisk.

In the reductions of the observations to a common epoch, we are handicapped by the absence of a magnetic observatory in the Northwest. Agincourt is too remote from the territory covered by our observations. There is no surety that the daily variation at Agincourt and at, say Edmonton, is always the same or that all magnetic disturbances felt at Edmonton are recorded at Agincourt, and *vice versa*. For this reason we have been anxious for some years now to have the Meteorological Service start a magnetic observatory in the Northwest. The only equipment necessary for our requirement is a self-recording declinometer. The director of the service has the instruments, but has experienced difficulty in getting a competent observer. It is hoped that the observatory will be in operation for the summer of 1916.

Returns received for 1915	2,147
Previous returns since 1908	6,853
Total returns to date	9,000
Dip observations received for 1915	85
Previous returns since 1908	351
Total force observations for 1915	59
Previous returns since 1908	260

Surveying Instruments.

As in the previous year, the instrumental equipment of the surveyors employed in the field was listed and, where thought advisable, inspected so that the office might be satisfied that only instruments in good condition and of approved pattern were being used on the surveys. It has been found that unless this is done there is a tendency among some surveyors to use instruments which are worn out and no longer fit for service.

Repairs were made to ninety transit theodolites, nineteen dumpy levels, twelve surveying aneroids, six surveying cameras, two abney levels, two recording thermometers, five stadia rods, eighty-five rod levels, and fifteen tripods.

Twenty-five sidereal watches were sent away to be overhauled and readjusted.

To give an idea of the volume of work in connection with the instruments, it may be stated that 455 cases of surveying instruments aggregating ten tons (20,054 pounds) were shipped from this office during the past year, and 179 cases aggregating 3½ tons (7,789 pounds) received.

A statement of the surveying instruments on hand on March 31, 1916, showing also the instruments purchased and sold during the year is given in Appendix 74.

General Work.

The Supplement to the Manual has been revised and the tables carefully checked by an independent computation. Two of the tables have been extended, and three which are not now used have been omitted. The text has been completely revised, and parts which had become out of date have been rewritten. There have also been added full descriptions of the astronomical and magnetic observations which are required by Dominion Land surveyors, and how they may best be taken. This matter formerly appeared in part in the Manual. New specimen observations have also been prepared.

An illustrated pamphlet has been prepared on the block survey transit describing and explaining the use of the specimen observations for azimuth, latitude, etc. The explanations are mostly those peculiar to this instrument, and not readily obtainable in text-books. The subject is covered fully, and the instructions with illustrations and sectional cuts afford a ready and comprehensive reference for the surveyor in the field. This pamphlet is now in the press.

In the rough mountainous country of the British Columbia railway belt a considerable amount of the surveyors' and assistants' time is taken up in computing the corrections required to reduce the distances chained on the slope to the horizontal. In the prairie provinces of Manitoba, Saskatchewan, and Alberta the surveyors use slope correction tables issued in convenient card form by this office for their reductions. But these tables are not sufficiently complete nor extended far enough for the steep slopes encountered in British Columbia, and it has been the practice of nearly all, if not all, the British Columbia surveyors in the past to use either natural or logarithmic tables to compute these corrections. Last year, specially complete and extended slope correction tables were computed, printed, and issued for the British Columbia men. This year, to further facilitate their work, "slope correction slide rules" have been designed and issued to them. These slide rules are simply the standard ten-inch Mannheim slide rule with a scale of versines in place of the usual scales of logarithms and tangents. Slope corrections for distances up to five chains and for slopes up to twenty-six degrees can thus be taken out with an accuracy of one-tenth of a link. The use of the rule is further extended by the addition of another standard number scale on its face, by which the difference of elevation in feet is given simultaneously with the slope correction. The rule has been very favourably received by the surveyors.

On Stadia and other traverses it is often rather difficult to locate survey posts upon which it is desired to tie or check. A general idea of the locality of the post sought for is afforded by roughly calculating the latitudes and departures of the lines. A rapid approximate method of making these calculations is supplied by an abacus which has been designed for this purpose and pasted in the back of the book for "Field Notes of Stadia Traverses."

The various methods of rapidly solving the astronomical triangle for time and altitude, azimuth by means of the abacus, the homogram, the solar attachment tables, etc., are under investigation. It is hoped that this interesting matter will be available for publication in the near future.

Surveys Laboratory.

Complete tests were made of twenty-six D.L.S. subdivision transits, four hydrographic survey transits, eight survey cameras, six clinometers, ten telescopes, four micrometers, two binoculars, and one monocular. Partial tests were made of seventy-one subdivision transits.

A complete analysis was made of the graduations of the horizontal circle of one of the base-line transits. This consisted of the determination of the eccentricity and ellipticity of the pivot, the periodic and accidental errors of graduation, the probable errors of the microscopes, of the graduations, etc.

Forty-one sidereal watches and five mean-time watches were submitted for trial, and forty-two of these passed through complete tests; the remaining four were withdrawn before the tests were finished.

Of the forty-two completely tested watches, thirty-two were put through the Surveys Laboratory test of forty-four days, eight passed the test and were then tested for fifty-five days according to the Bureau of Standards method, and ten were tested according to the Bureau method only.

Of the thirty-two watches completing the Surveys Laboratory test, twenty-one, or sixty-six per cent, passed as against thirty-nine per cent in 1915. Of the eight subjected to both tests, five passed and three failed the Surveys Laboratory test, and one passed and seven failed the Bureau of Standards test. Of the ten completing the Bureau of Standards test only, seven passed and three failed.

The results of the trials of the watches which passed are given in Appendix 73.

For the twenty-one which passed the Surveys Laboratory test, the average errors for isochronism were as follows:—

P.U.	P.R.	P.L.	D.U.	D.U	D.U.	D.D	P.U.
0s.49	0s.39	0s.52	0s.60	0s.41	0s.34	0s.41	0s.76

The smallest error for a was $0^s.23$.

The average errors for position were

P.U.	P.R.	P.L.	D.U.	D.D.
2s.76	2s.73	2s.19	1s.35	1s.53

The smallest error for β was $0^s.75$.

The average temperature coefficient was $0^s.09$.

Comparing the average errors with those for 1915 we have the following:—

	1915.	1916.
Average error for isochronism	0s.53	0s.49
" position	1.89	2.08
" compensation	0.08	0.09

The largest average error in isochronism for both those which passed and those which failed was, as in 1914, in the P.U. position. The lowest average error for those which failed was, as in 1914 and 1915, in the D.D. position, but for those which passed it was in D. U. position.

In position, the largest average error for those which passed was, as in 1914 and 1915, in the P. L. position.

Of the watches which failed, four, or thirty-six per cent, failed in isochronism, nine, or eighty-two per cent, in position, and two or eighteen per cent in both isochronism and position.

All passed the test for temperature of compensation.

In connection with the testing and rating of the watches, thirty-eight time observations were taken.

One hundred and fifty stadia cards were computed, printed, and issued to the surveyors.

At the Comparator building, the base was verified seventy-one times by the standard four-metre rule; eighty intercomparisons of the laboratory standards and four hundred and twenty-nine comparisons of the standards with the base were made. Besides the above, the lengths and weights of twenty-one tapes of all kinds were determined and three elasticity tests were made.

At the Surveys Laboratory, part of a proposed electric heating system has been installed in order that the experiments may be carried on at a more nearly standard temperature during a longer period of the year than has previously been possible. Progress has continued to be made in improving the apparatus. A second testing stand has been installed for determining stadia constants, value of micrometer screws, etc., so that during busy periods instruments may be turned out at a much faster rate. Work at the Surveys Laboratory, however, is becoming very much handicapped by lack of space. The main room in which the greater portion of the tests are carried on is but eleven feet by sixteen feet, is quite inadequate for the amount of apparatus installed therein and is very cramped when more than two observers are working at the same time on different tests.

Comparator.

The comparator standard has been a four-metre invar bar. Invar has a very low coefficient of thermal expansion but unfortunately is subject to molecular change, especially when exposed to shock or extreme temperature variation. It is therefore necessary that such a standard should be verified fairly frequently. It was originally intended to return the bar from time to time to the International Bureau at Paris for recomparison with the international standards. The vicissitudes through which the bar passed on its first journey here showed clearly however that this was not practicable. After considerable thought had been given to this matter and several letters had passed on the subject with Dr. Guillaume, the Director of the International Bureau, it was finally decided to purchase a one-metre bar for our primary standard. There would be no difficulties connected with the transportation back and forth to Paris of a one-metre bar and it could be verified as often as desired. As the interval between piers (four metres) still required the four-metre bar to be used in all comparator measurements, the four-metre bar would be verified by comparison with the one-metre bar. This plan has the added advantage that the primary standard is not constantly in use as is the case with the four-metre bar and the danger of accidents to our primary bar is thereby very materially lessened. In order to permit verification of the four-metre bar by the one-metre standard some additional apparatus was required and the installation of this has just been completed. On the original comparator only multiples of four metres, ten metres, thirty metres, fifty feet and sixty-six feet could be standardized. The auxiliary apparatus increases the range of the comparator so that now any length may be standardized. While the apparatus has been installed the one-metre bar has not as yet been received, owing to various delays mainly arising out of the troubled conditions in Europe.

A short description of the primary base apparatus is given herewith. It is a general description given in advance of a more complete one at present delayed awaiting the completion of some exhaustive experiments. Results are also given of the friction tests on the tape-supporting pulleys of the base apparatus. Those for the secondary apparatus were given in the report for 1914-1915.

Comparator Building.—One of the most difficult problems in the standardization of measures of length is in controlling and determining the temperature at which the standardization is made. For this reason it was necessary to construct a building of unusual and special design. It is necessary that the exact temperature of the tape be known and that this temperature be uniform throughout its length. The building had to be such that a constant internal temperature could be maintained for long

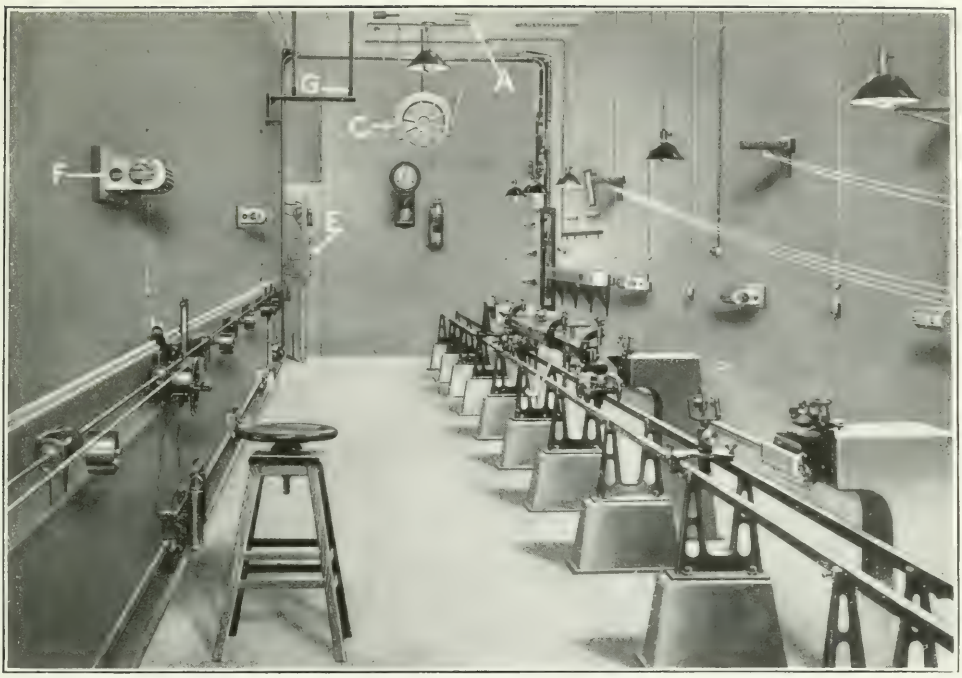

Fig. 1. North End.

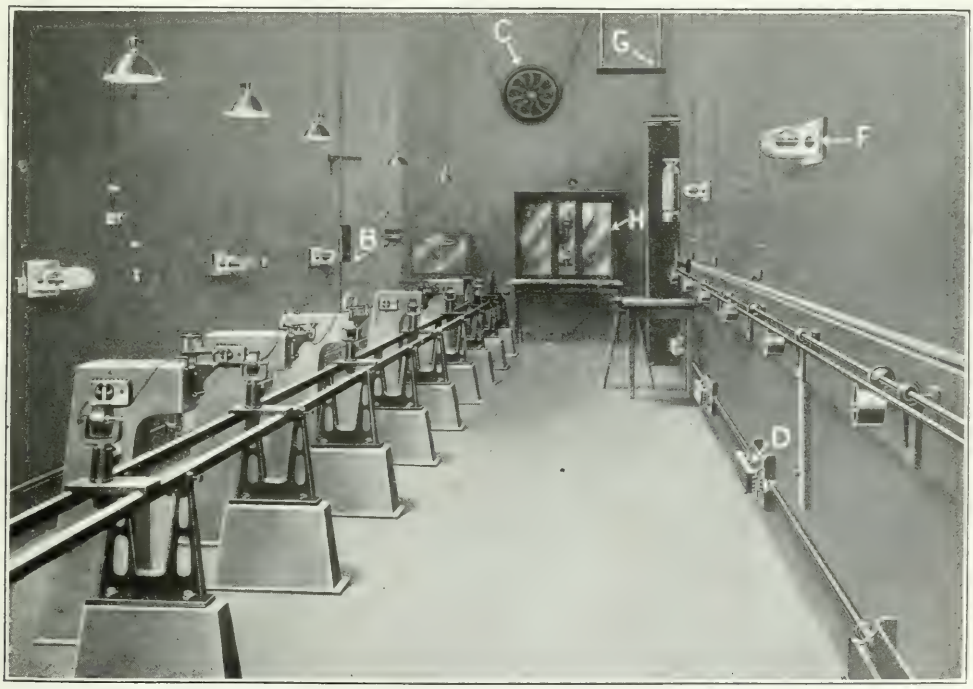

Fig. 2. South End.
View of Comparator Room.

periods independent of outside conditions and also that the temperature could be regulated to as near as possible the standard temperature for testing (16.7° C.).

These objects are attained by insulating the walls, floor and roof of the testing room and keeping the openings to the outside air down to the minimum necessary for proper ventilation and by the provision of a system of electric heaters. A pair of blower fans supported from the ceiling at each end of the room (C) Figures I and II, serve to keep the air in circulation and so maintain a uniform temperature throughout the room. In the extremely hot weather the ventilators are opened at nights only and the fans kept running. The inside dimensions of the main room are 150 feet long, ten feet six inches wide and twelve feet high. The walls are approximately four feet thick and consist of five thicknesses of brick, a one-inch air space, one-inch wood sheeting, tar paper, eighteen inches of shavings, one-inch wood sheeting, four-inch air space, tar paper, and finally double wood sheeting. Between the ceiling and the roof is a layer of shavings four feet thick, and beneath the floor a layer two feet in thickness; under this are cinders for a depth of five feet to the solid rock. The only openings besides the door are two air intakes (B) Figure II, one at each end of the room, and four ventilators (A) Figure I, in the ceiling. The air intakes (which are at the base of the wall) are arranged so that the quantity of air admitted can be regulated, and during the tests can be completely shut off. The ceiling ventilators can be closed completely or opened any desired amount for ventilation. The exit into the outer room is of special construction, consising of two doors with a four-foot air space between. The outer door is of the ordinary type, while the inner one is an insulating air-tight door of the refrigerator design.

The heating system consists of eighteen electric heaters (D) Figure II, evenly distributed around the base of the walls, and one large heater in each of the two air inlets. The heaters are of the three-stage type, giving low, medium, and high degrees of heat, and are arranged in two separate circuits (independent of the air intake heaters). They may be controlled closely from a Vermont marble switchboard (E) Figure I.

At all ordinary times the temperature of the room is regulated to about 16.7°C, this being the temperature at which the base measurements are made. A recording thermometer gives the degree of regulation attained and the smoothness of the curves of temperature show how well the building is insulated.

Comparator Apparatus.—Generally speaking, the existing bases for the standardization of wires and tapes are of two kinds: First, the permanent bench-marks of microscopic construction (*e.g.,* Russian bases at Petrograd), and secondly, the permanent bench-marks consisting of lines traced on the edges of a series of polished surfaces fixed in positions (*e.g.,* bases at Bureau International and the National Physical Laboratory). After careful consideration, the latter of the two systems was adopted. The apparatus was constructed by "La Société Genevoise, Pour la Construction d'Instruments de Physique," Geneva. The permanent base consists of a concrete monolith supported on the solid rock with piers bearing the bench-marks projecting up through the floor at certain intervals. These piers are situated at 0^m, 4^m, 8^m, 16^m, 12^m, 50 feet, 16^m, 20^m, 66 feet, 24^m, 28^m, 30^m, 100 feet and 32^m. The bench-marks consist of highly polished plates bearing fine graduations, fixed in cast-iron brackets bolted to the front of the piers. These brackets also bear small electric lamps for illuminating the fields of the micrometer microscopes and rests for supporting tapes when being compared with the bench-marks.

In front of the bench-mark piers throughout nearly the whole length of the room a series of smaller piers carry rails. The carriage bearing the rule, microscopes, etc., travels along these rails which also serve as a support for the pulley brackets, end fixtures, and other attachments used in comparing tapes with the bench-marks. The carriage consists of a piece of trussed angle-iron supported at each end by a three-wheeled truck. There is an independent raising and transverse adjustment at

each end, the truck at the north end having also a clamp and slow-motion screw attachment for making longitudinal adjustment when setting the bar in position for reading. Supported at two points at a distance of 2·26^{m} apart on the carriage is the invar bar four metres in length, one end resting on a saddle and the other on a roller. On the back of the angle-iron are slides on which fit the brackets carrying the micrometer microscopes, one being used always at each end of the carriage and the third at any intermediate part when piers of less than four metres spacing are being standardized. The bar is protected from air currents and accident by a metal casing having small openings covered by slides so that the bar may be brought close up to the bench-mark. The bar is of special section with graduations on the neutral surface. The first metre is divided into millimeters and the other graduations are at 2^{m}, 2·48^{m}, 3^{m}, 3·24^{m} and 4 metres, one millimetre being shown on each side of these latter graduations. Two thermometers record the temperature of the bar. The bulbs are enclosed in invar blocks making metallic contact with the bar and small microscopes in the protecting cover on the carriage enable the thermometers to be accurately estimated to ·01°C., the graduations being in tenths of a degree. The micrometer microscopes have a magnifying power of about twenty. A micrometer is fixed in the focus of the eye-piece consisting of a fine screw, with 2·19 threads per millimetre and a pair of close parallel hairs carried by a frame. The drum is divided into 100 parts and one turn corresponds to 0·1^{mm}. The exact value of one turn is obtained after the adjustments are checked before establishing the base and after the measurement, the mean of the two values being used in reducing the results. The four-metre bar was standardized and its coefficient of expansion determined at the Bureau International. At 0°C the length between 0^{m} and 4^{m} graduations is 3·999975^{m} and the coefficient of expansion is (0·000001738T-.00000000509T^{2}). To protect the bar from a local heating effect due to the breath of the observers when readings are being taken, detachable breath-shields are fitted to the microscope brackets.

During tape tests the carriage is moved beyond the end pier. Tapes when compared with the bench-marks may either hang in a single catenary, (the rail brackets being of U form to allow of this method of test) or be supported at close intervals on special pulleys. Tension is imparted by a wire fastened to one end of the tape and passing over a grooved pulley, weights being added to the wire according to the desired tension. The pulley is of steel twelve inches in diameter, running on ball bearings with fine adjustment both vertically and horizontally. The other end of the tape is attached to a support giving longitudinal, transverse, and vertical adjustment. It has been found that owing to the small amount of friction in the apparatus in its improved form, it is necessary to have one end of the tape fastened to a fixed point in order that it will remain stationary during readings.

Twelve mercury thermometers (Tonnelot) are supported horizontally in protecting guards at intervals around the walls. These thermometers have been carefully standardized and from time to time their ice points are verified by the usual method. They are graduated to one-tenth of a degree (C) and are estimated to one-hundredth of a degree. A reading is taken when observers change places at the middle of the test and the mean reduced temperature of the twelve thermometers gives the temperature of the air in the room during the comparison. In order that the temperature of the observer's body may not affect the reading of these delicate thermometers they are viewed from a distance by means of a special reading telescope designed for the purpose and supported on the rails in front of the bench-marks. When the atmospheric pressure is abnormal corrections have to be applied to the observed readings. A mercury barometer hangs on the wall at the door end of the room for obtaining the pressure at the time of testing. An error of $\frac{1}{10}$° C. in the temperature of a 100-foot tape would cause an error of 0·0001 feet in the computed length.

Variation of Base.—In September, 1914, a series of experiments was started with the object of investigating the alterations in length of the base during the year and to

determine to what extent any variation found would affect the ordinary testing. The length has been determined weekly since the commencement of these experiments which are still proceeding. The results of the first year's work are given herewith in graphical form together with a curve showing the mean outside temperature during the same period. The vertical scales for the three distances shown in the curves are inversely proportional to the distances themselves i.e., if the alterations in length were proportional to the pier spacing, the difference of ordinates would be constant. It will be noticed that the change in length is very regular for each distance and has a distinct periodic appearance, the point of maximum length being in September and the minimum in March. Although the extreme variation of the whole base is about 1^{mm}, not two consecutive weekly determinations differ by more than ninety microns. At times the length has been determined on two consecutive days when the greatest daily variation so far observed has been fifteen microns. This quantity represents a variation of approximately one in 2,000,000 in the total length of the base, so that no appreciable error is introduced in regarding the length of the base as constant for some hours after standardization during which tapes are verified.

It will be seen that the fifty-foot length has a slightly greater proportional variation than the 100-foot and 32^{m}. Our weekly determinations reveal the fact that the spaces between the piers do not alter quite uniformly, those towards the ends showing the greater variation, the effect being more marked towards the zero end. The form of the curves is similar to that for the air temperature but with a lag of about two months. This appearance is what would be expected if the length of the monolith were affected by temperature. Published results of underground temperature for a depth of a few feet show a similar variation to outside air temperature with a lag proportional to the depth. In this connection it is proposed to install an appropriate thermometer so that the exact temperature of the monolith may be obtained in connection with these investigations of the length of the base.

Friction of tape-supporting pulleys.—The original tape-supporting apparatus as supplied for the permanent base consisted of single pulleys fitted to stands which rest on the rails in front of the bench-mark piers. The pulleys were of brass of heavy section and weighed 1·83 pounds each. They had a vertical adjustment to enable them to be lined up horizontally. The end-grooved pulleys for carrying the tension wire were of similar section and had lateral as well as vertical adjustment. It was felt that the amount of friction in these pulleys owing to their weight and the design of bearings would have an unduly large effect on tape comparisons made with the base apparatus.

Having determined the amount and effect of the friction, it was compared with the results obtained on the new secondary apparatus. The friction was found to be considerably greater, and it was decided to re-design the pulleys with the object of materially reducing it. The experiments which had been carried out on the original pulleys determined the amount of friction in the pulleys and also the effect of friction on the length of tapes when compared with the base. Briefly, the actual amount of friction expressed as a force in the line of tension at the periphery of the pulleys was found by winding a silken thread around the pulley and adding weights until the pulley revolved without any apparent acceleration, this being done for several positions and in both directions of rotation. In the case of the tension pulley the wire used in tape tests was employed, weights being attached to the ends of this in order that the amount of friction might be found under working conditions. The actual effect on the observed length of a tape was obtained by setting the zero of a tape opposite the zero graduation on the base and taking readings at the other end. Settings were made alternately from left to right when the tension at the zero end would be the sum of the tension and the friction, tending to decrease the sag effect and right to left when the opposite would be the case, the tension at zero end being the difference of the tension and the friction. It is apparent that the more friction there is in the pulleys the

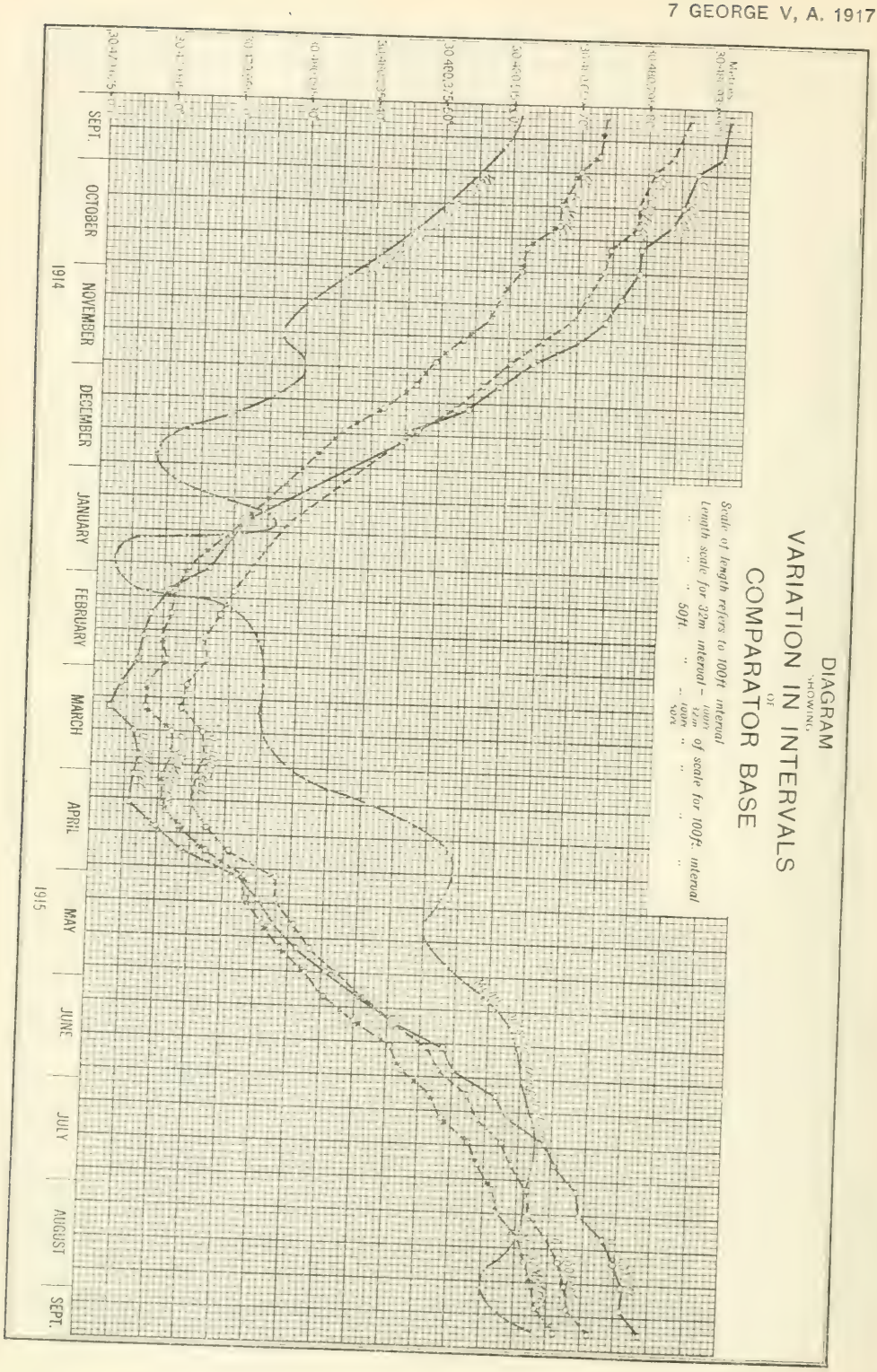
DIAGRAM
SHOWING
VARIATION IN INTERVALS
OF
COMPARATOR BASE
Scale of length refers to 100ft. interval
Length scale for 32m interval = 100ft. of scale for 100ft. interval
" " " 50ft " " = 100ft. " " "
Metres
SEPT.
OCTOBER
NOVEMBER
DECEMBER
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPT.
1914
1915

more would be the discrepancy between alternate settings, owing to the friction affecting the actual tension in the tape and so altering the amount of sag between the different pulleys. The following is a summary of the results obtained:—

First method.

Amount of friction expressed as alteration of tension in line of the tape.

Tension Applied.	Friction.	
	Tension pulley only.	Tension pulley + 7 intermediate pulleys.
10 lbs.	10·6 grms.	27·8 grms.
10 kgms.	18·1 "	35·2 "

Second method.

Effect of friction on setting determined by moving tape from opposite directions and comparing with bench-marks.

Tension Applied.	Length of Tape.	Mean Difference of Readings.	
		Tension pulley only.	Tension pulley + 7 intermediate pulleys.
10 lbs.	66 ft.	·035mm	·015mm
10 kgms.	66 "	·019 "	·035 "
10 lbs.	100 "	·157 "	·017 "
10 kgms.	100 "	·029 "	·033 "

After the completion of this test new pulleys were made, these being adapted to the old brackets and stands. The new tension pulley is of steel twelve inches in diameter and the intermediate pulleys of aluminium alloy 3⅝ inches diameter, weighing 1·93 ounces each. When the new pulleys were installed a further series of similar experiments were carried out. The results of the tests are as follows:—

First method.

Amount of friction expressed as alteration of tension in line of tape.

Tension Applied.	Friction.	
	Tension pulley only.	Tension pulley + 7 intermediate pulleys.
10 lbs.	3·2 grms.	3·86 grms.
10 kgms.	5·3 "	5·96 "

Second method.

Effect of friction on setting determined by moving tape from opposite directions and comparing with bench-marks.

Tension Applied.	Length of Tape.	Mean Difference of Readings.	
		Tension pulley only.	Tension pulley + 7 intermediate pulleys.
10 lbs.	66 ft.	·013 mm	·008mm
10 kgms.	66 "	·003 "	·005 "
10 lbs.	100 "	·021 "	·011 "
10 kgms.	100 "	·012 "	·012 "

PHOTOGRAPHIC OFFICE.

Owing to the reduction in our staff due to the absence of one member, who is on active military service, and to other unusual conditions, the output of the photographic office shows a small decrease.

To avoid procuring extra assistance, as much as possible of the blue and black-line printing was sent to the Railway Lands Branch, where special equipment for doing such work expeditiously is installed. The remainder, such as prints from glass-line negatives, were made, for the time being, by the process photographers.

However, additional work such as developing some hundreds of photographic dry plates used in topographical survey operations, more than made up for the work sent out.

The plates used for this kind of work in the past have been of the ordinary or colour-blind variety, but this season panchromatic plates were used; these, being sensitive to all colours, had to be very carefully handled, that is, the loading into the plate holders and, after exposure, unloading and packing for shipment, had to be done in the dark.

The plates were developed in tanks by the time-and-temperature method, a fixed time of development at a known temperature, say thirty minutes at sixty-five degrees, plates not being looked at till after fixing. The manipulations were, of course, in darkness or practically so.

Although this make of plates was new to us and to the surveyors in the field, the results were good; with further experience both in exposing and developing, they ought to be very satisfactory.

From these and many hundred other survey negatives, which were not developed at this office, contact prints and enlargements were made, the enlarged prints being used in plotting the survey.

To turn out all this so as not to cause any delay to the various parties in plotting their work, and at the same time attend to the other duties of the office, kept our small staff fully occupied, some of the less important work, such as bringing our office albums up to date, being held over.

The fixed focus enlarging camera on which all the survey enlarging is done, and which had been rebuilt in preparation for this season, has proven very satisfactory. It is more compact, more convenient to handle, and the definition of the enlarged print is better than with the old camera. One of the staff attended the Kodak Photographic School held at Montreal for three days. Much valuable information pertaining to photography in general was secured, which will be of benefit in future work.

SESSIONAL PAPER No. 25b

PHOTOLITHOGRAPHIC OFFICE.

The duties of this office are to prepare photo-lithos on zinc and aluminum of maps, plans, etc., for the power printing presses, and also the making of reductions and enlargements for the convenience of the drafting division.

These photo-lithos are made from drawings in black drawing ink, prepared by the drafting division. First a negative is made and then carefully retouched, spotting out all defects and correcting any errors. A sheet of specially grained zinc is coated with a sensitized solution, and when dry is exposed to the light, when it is then inked in. This is developed under running water, dried off with a fan, and sent to the press for printing.

During the past year over one thousand township plans have been put through in this manner, together with three- and six-mile sectional maps and various forms of townsites and other plans.

Some of the higher-class maps published in this office are first engraved on copper. Experiments are now being carried on in copper-plate intaglio etching to take the place of these plates at a reduced cost.

There is a slight decrease in the number of negatives this year compared to last year, but a greater number of the larger size were made.

We are now prepared to copy coloured maps, and other documents by the aid of panchromatic plates and coloured filters.

BOARD OF EXAMINERS FOR DOMINION LAND SURVEYORS.

The Board of Examiners for Dominion Land Surveyors held three meetings. The first was a special meeting lasting from May 3 to June 25 (inclusive), 1915, during which examinations were held at Ottawa, Toronto, Winnipeg, Calgary, and Dawson. The second was another special meeting which took place on September 24, 1915. The third was the regular annual meeting called for by section 9 of the Dominion Lands Surveys Act. It began on Monday, February 14, 1916, and lasted until March 31, 1916. During this meeting examinations were held at Ottawa, Toronto, Montreal, Kingston, Winnipeg, Calgary, Edmonton, Vancouver, and Dawson. The total number of candidates for examination was 202. Of these, 144 tried the preliminary examination, 55 tried the final examination, and 3 tried the examination for Dominion Topographical surveyor.

Thirty-seven candidates were successful at the preliminary examinations as follows:—

PRELIMINARY EXAMINATION.

Atkins, Samuel Clements, Ottawa, Ont.
Atkinson, Nelles Henry, Calgary, Alta.

Bayly, Gilbert St. John, Rocky Mt. House, Alta.
Berton, Francis George, Dawson, Y.T.
Boyle, Joseph Whiteside, Dawson, Y.T.
Breen, Joseph Melville, Long Branch, Ont.
Brennen, James Hugh, Ottawa, Ont.
Brennen, Herbert, Ottawa, Ont.

Chisholm, Austin Joseph, Woodstock, Ont.
Cole, Arthur William Willoughby, Ottawa, Ont.
Cunningham, Frederick J., Ottawa, Ont.

Dalglish, Bruce M., Ottawa, Ont.
Davis, Vernon R., Franklin, Man.
Dewar, Charles Leonard, Ottawa, Ont.
Dunbar, John Robert, Ottawa, Ont.

Elliot, Herman James, Toronto, Ont.
Evans, William Lloyd, Hamilton, Ont.

Gordon, Donald Cameron, Ottawa, Ont.

Henderson, John Archibald Hamilton, Ottawa, Ont.
Hogarty, Bertrand, Portage la Prairie, Man.
Huggins, Frank William, Ottawa, Ont.
Hurlbert, Bernard Hatfield, Tusket, Yarmouth, Co., N.S.

Moorehouse, Edmund Lloyd, Medicine Hat, Alta.

Ogburn, Robert Henry, Dawson, Y.T.

Pearson, Grant Price, Schomberg, Ont.

Read, Hiram Earle, Edmonton, Alta.
Robertson, Douglas Mills, Edmonton, Alta.
Rochester, Bertram Cole, Ottawa, Ont.
Rose, Hugh Grant, Ottawa, Ont.

Scott, Cecil Raymond, North Bay, Ont.
Stewart, James R., City View, Ont.

Thompson, William Kirk, Toronto, Ont.
Thomson, Alexander Muir, Ottawa, Ont.

Wadge, Harold, Regina, Sask.
West, Gordon O., Ottawa, Ont.
Williams, Howard J., Kingston, Ont.
Wood, George H., Kincardine, Ont.

Twenty-seven candidates were successful at the final examination as follows:—

FINAL EXAMINATION.

Ball, Alfred Nepean, Grenfell, Sask.
Britton, George Clayton, Whitby, Ont.

Carroll, John, Toronto, Ont.
Clouston, Noel Stewart, Winnipeg, Man.
Cram, Alexander Scott, Westboro, Ont.

Davidson, R. Douglas, Port Rowan, Ont.

Fullerton, James Thornton, Victoria, B.C.

Gardner, James David, Ottawa, Ont.

Keeping, Kimball, Murray Harbour, P.E.I.
King, Arthur Harry, Maitland, N.S.
Knight, Sidney, Edmonton, Alta.

McIntosh, John Stuart, Morrisburg, Ont.
McLaren, Arthur Anthony, Mitchell, Ont.
MacTavish, William Higgins, Van Camp, Ont.
Mills, Thomas Stanley, Kingston, Ont.
Murdie, William Campbell, Seaforth, Ont.

Phillips, Edwin Percy Aryall, Oshawa, Ont.

Riddell, John Morrison, Toronto, Ont.
Robinson, Edward Keith, Kingston, Ont.

Sauder, Penrose Melvin, Calgary, Alta.
Sibbitt, William Algernon, Bracebridge, Ont.
Smith, Leonard Ross, Richdale, Alta.
Stewart, Alan D., Ottawa, Ont.

Thomas, Llewellyn Olding, Ottawa, Ont.

Wight, Edmund James, Ottawa, Ont.
Wood, Norman C., Kamloops, B.C.
Wood, James Russell, Peterboro, Ont.

The time of the board, during the meetings, was largely taken up with the reading and valuation of the candidates' answer-papers. Complete sets of question-papers, to be used at the next examination, were also prepared. In addition to this, the evidence submitted by candidates at the final examination, in proof of their eligibility therefor, had to be examined. This evidence consisted of certificates of Provincial land surveyors, and of affidavits of service under articles of apprenticeship.

Nine candidates who presented themselves for final examination, had not quite completed their time under articles. They were admitted on the understanding that in case they were successful, their commissions would not issue until they had completed their apprenticeship and furnished affidavits in the regular form.

The board had to consider several applications which were received from college and university graduates asking to be admitted to the privileges of section 22 of the Surveys Act which provides for a shorter term of service under articles. One candidate who produced a diploma from McGill University, showing that he had successfully passed the third-year examination in civil engineering, was admitted to the shorter term of service.

Thirty commissions were issued to candidates who had passed the final examination, and had furnished oaths of office and allegiance and bonds for the sum of one thousand dollars, as required by section 25 of the Dominion Lands Surveys Act.

Twenty-seven certificates of preliminary examination were issued to successful candidates who had complied with the requirements of the law.

Section 35 of the Dominion Lands Surveys Act provides that every Dominion Land surveyor shall be in possession of a subsidiary standard of length. During the year, twelve new standards were issued to surveyors. Two Ontario Land surveyors, who were also Dominion Land surveyors, sent their O.L.S. standard measures to be tested. These being in good condition and of the same pattern as the Dominion standard, they were tested at the Surveys laboratory and re-issued as subsidiary standards of length.

Under the provisions of section 53 of the Dominion Lands Surveys Act, the following fees must be paid to the secretary by each candidate who has successfully passed the examination for admission as a Dominion Land surveyor:—

(*f*) By each applicant obtaining a commission, two dollars;
(*g*) For admission to practise after receiving a commission, twenty dollars.

Hitherto, the secretary had collected the two fees (*f*) and (*g*) on the issue of the commission, which was considered to be the "admission to practise." In March last, however, the Deputy Minister of Justice advised that the right to a commission and

the right to practise are two separate things, for which separate fees are payable. As no surveyors apply for admission to practise, the collection of the fee of twenty dollars, (*g*) has practically ceased.

APPENDICES.

No. 1.—Schedule of surveyors employed and work executed by them.
No. 2.—Schedule showing for each surveyor employed, the number of miles surveyed of section lines, township outlines, traverses of lakes and rivers, and resurvey, also the cost of the same.
Nos. 3 to 71.—Abstracts of reports of surveyors employed.
No. 72.—Results of magnetic observations.
No. 73.—Results of watch tests.
No. 74.—List of surveying instruments on hand, March 31, 1916.

MAPS AND PROFILES.

The following maps accompany this report:—
1. Map to illustrate progress of Dominion Land Surveys, to March 31, 1916.
2. Map showing topography and profiles of base lines and meridians run during the year.

I have the honour to be, sir,
Your obedient servant,

E. DEVILLE,
Surveyor-General.

TOPOGRAPHICAL SURVEYS BRANCH.

SCHEDULES AND STATEMENTS.

APPENDIX No. 1.

SCHEDULE of Surveyors employed and work executed by them.

Surveyor.	Address.	Description of Work.
Akins, J. R.	Ottawa, Ont.	Production of the Sixth meridian from the NE. cor. tp. 90 to the NE. cor. sec. 12, tp. 127; the 27th base line from the NE. cor. sec. 33, tp. 104-22-5, to the Sixth meridian; and the 30th base line across part of range 1, west of the Sixth meridian. Resurvey of the 29th base line across range 24, west of the Fifth meridian.
Aylsworth, C. F.	Madoc, Ont.	Retracement in tp. 12-10-E., tps. 24 and 25-27-Pr., tp. 26-30-Pr., and tps. 23, 28 and 29-31-Pr. Resurvey of the north outline of tp. 12-9-E. Stadia surveys in tp. 23-27-Pr. and tps. 24 and 25-28-Pr.
Baker, J. C.	Vermilion, Alta.	Subdivision of tp. 94-10-4, tps. 94 and 96-11-4 and parts of tps. 95 and 97-11-4. Traverse in tp. 95-10-4.
Baker, M. H.	St. Thomas, Ont.	Resurvey in tp. 17-11-E., tp. 4-17-Pr., tp. 24-2-2, tp. 28-18-2, tps. 30, 31 and 38-26-2, tps. 30 and 31-27-2, tps. 30 and 31-28-2, and tp. 28-7-3. Retracement in tp. 25-22-Pr., tp. 44-25-Pr., tps. 1 and 2-8-2, tps. 1 and 2-9-2, and tp. 22-23-2. Correction survey in tp. 37-26-Pr., tp. 19-8-2, tp. 7-10-2, tps. 24, 25 and 27-24-2, tp. 40-26-2, and tp. 51-3-3. Survey of parcel of land for water-power reservation in sec. 23, tp. 15-12-E. Survey of portions of the old Dawson road in tp. 8-6-E., tp. 8-7-E. and in the parish of Ste. Anne des Chênes. Survey of agricultural land in tp. 15-4-Pr. and of cemetery in sec. 17, tp. 5-27-2. Traverse of road along the north shore of Arcola lake in sec. 24, tp. 10-3-2. Resurvey of lots 19 and 20 in Fairford settlement, and of blocks 4 and 11 at Wymark, sec. 29, tp. 13-3-3.
Bélanger, P. R. A.	Ottawa, Ont.	Resurvey of part of Lac La Biche settlement. Subdivision in tp. 67-13-4. Correction survey in tp. 67-13-4 and tp. 67-15-4.
Bennett, G. A.	Tillsonburg, Ont.	Stadia surveys in tps. 34 and 35-6-3, tp. 32-13-3, tp. 32-14-3, tp. 31-15-3, tps. 34, 36 and 37-16-3, tps. 31, 32, 33, 34 and 36-17-3, tps. 29 and 31-18-3, tps. 27 and 30-19-3, tps. 27 and 28-20-3, tps. 27, 28 and 29-21-3, tps. 27 to 30-22-3, tps. 27 to 36-23-3, tps. 31 to 36-24-3, tps. 31 to 36-25-3, tps. 31 to 37-26-3, tps. 31 to 36-27-3, tps. 31 to 37-28-3, and tps. 31 to 36-29-3.
Blanchet, G. H.	Ottawa, Ont.	Survey of the east outlines of tp. 37 and part of tp. 38-3-E., tps. 33, 34, 35 and 36-6-E., tps. 29, 30, 31 and 32-7-E., and tps. 27, 28 and part of tp. 26-9-E., and the north outlines of tp. 36-4-E., tp. 36-5-E., tp. 36-6-E., part of tp. 32-6-E., tp. 32-7-E., part of tp. 29-7-E., part of tp. 28-5-E., tp. 28-6-E., tp. 28-7-E., tp. 28-8-E. and tp. 28-9-E.

SCHEDULE of Surveyors employed and work executed by them—*Continued.*

Surveyor.	Address.	Description of Work.
Boulton, W. J.	Wallaceburg, Ont.	Stadia surveys in tp. 13-15-4, tps. 13 and 14-16-4, tp. 14-17-4, tps. 12, 13 and 14-18-4, tps. 6, 7 and 11 to 14-19-4, tps. 6 to 14-20-4, tps. 7 to 15-21-4, tps. 8, 9 and 12-22-4, tp. 18-28-4, tps. 18, 19 and 24-29-4, and tp. 24-1-5. Retracement in tp. 13-17-4.
Bowman, E. P.	West Montrose, Ont.	Stadia surveys in tps. 45, 46 and 47-10-3, tps. 45 and 46-11-3, tps. 42, 43 and 44-13-3, tp. 51-14-3, tps. 50 to 52-15-3, tps. 50 to 53-16-3, tps. 46 and 50 to 53-17-3, tps. 48, 49 and 51 to 53-18-3, tps. 48 to 52, 54 and 55-19-3, tps. 49 to 55-20-3, tps. 49 to 52 and 54-21-3, tps. 51 and 52-22-3, tp. 51-23-3, tps. 50 and 51-24-3, tps. 49 and 50-25-3, and tps. 49 and 50-26-3.
Brenot, L.	Ottawa, Ont.	Part subdivision of tps. 82, 83 and 84-17-6, tp. 84-22-6, tp. 83-23-6, tp. 83-24-6, and tp. 82-25-6. Survey of the east outlines of tps. 83 and 84-26-6. Traverse in tp. 85-17-6.
Bridgland, M. P.	Calgary, Alta.	Photo-topographical survey and triangulation in Jasper Park.
Brownlee, J. H.	Dawson, Y.T.	Mineral claim, base line and miscellaneous surveys in the Yukon Territory.
Buchanan, J. A.	Edmonton, Alta.	Subdivision of tps. 91 and 92-20-5 and tps. 90, 91 and 92-21-5.
Calder, J. A.	Lytton, B.C.	Subdivision in tp. 22-21-6, tp. 15-23-6, tps. 15, 16 and 20-24-6, tp. 22-25-6, tps. 19, 20 and 21-26-6, and tp. 18-28-6. Traverse in tps. 15, 16 and 20-24-6, tps. 19, 20 and 21-26-6, tp. 22-21-6 and tp. 22-25-6.
Christie, W.	Prince Albert, Sask.	Subdivision of tp. 53-21-2 and tp. 53-24-2. Part subdivision of tp. 53-20-2, tp. 52-21-2, tps. 53 and 54-22-2, tp. 54-23-2 and tp. 54-24-2. Retracement of the 15th base line across ranges 22 to 27, west of the Second meridian. Survey of Red Rock mineral claim in sec. 21, tp. 49-25-2.
Coltham, G. W. (Owing to illness of Mr. Coltham, charge of party was later transferred to E. S. Martindale.)	Aurora, Ont.	Stadia surveys in tp. 43-28-3, tps. 42 and 43-1-4, tps. 43 and 44-2-4, tps. 43 to 45-3-4, tps. 43 and 44-4-4, tps. 43 to 46-5-4, tps. 43 to 46-6-4, tps. 43 to 46-7-4, tp. 45-8-4, and tps. 44 and 45-9-4.
Coté, J. M.	Ottawa, Ont.	Resurvey of tps. 43 and 44-2-3, tp. 47-22-3 and tp. 27-27-3. Miscellaneous surveys in tp. 41-23-2, tp. 43-27-2, tps. 43 and 45A-28-2, tp. 40-14-3, tps. 30 and 31-21-3 tp. 51-23-3 and tp. 27-28-3.
Cowper, G. C.	Welland, Ont.	Stadia surveys in tps. 17 and 19-7-3, tps. 15 to 19-8-3, tps. 15 to 19-9-3, tps. 15 to 19-10-3, tps. 15 to 18-11-3, tps. 15 to 18-12-3, tps. 16 to 20-13-3, tps. 16 to 20-14-3, tps. 15 to 21-15-3, tps. 12 to 21-16-3, tps. 13 to 17 and 19 to 22-17-3, tps. 9, 10, 12, 14 to 16 and 18 to 22-18-3, tps. 8 to 10, 16 and 18-19-3, tp. 6-20-3 and tp. 6-21-3.
Cumming, A. L.	Cornwall, Ont.	Subdivision of tp. 41-10-5, part subdivision of tp. 41-9-5, tp. 39-10-5, tps. 39 and 40-11-5. Retracement in tp. 40-10-5.
Davies, T. A.	Edmonton, Alta.	Subdivision of tps. 80, 81, 83 and 84-5-6, the west half of tp. 82-5-6 and the east third of tp. 80-6-6.
Day, H. S.	St. John West, N.B.	Subdivision of tps. 81, 83 and 84-6-6.
Deans, W. J.	Brandon, Man.	Inspection of surveys performed during 1915 by Messrs. W. Christie, D.L.S., O. Rolfson, D.L.S., W. A. Scott, D.L.S., and J. W. Tyrrell, D.L.S. Reinspection of contract No. 27 of 1913. Miscellaneous surveys in tp. 5-9-E., tp. 24-6-E., tp. 21-5-Pr., tps. 20 and 21-6-Pr., tp. 20-7-Pr., tp. 18-20-Pr., and tp. 13-13-3. Traverse in tp. 51-26-2.

SESSIONAL PAPER No. 25b

SCHEDULE of Surveyors employed and work executed by them—*Continued.*

Surveyor.	Address.	Description of Work.
Evans, S. L.	Corinth, Ont.	Resurvey of tp. 13-27-2. Retracement and subdivision in tp. 15-4-3, tps. 15, 16 and 17-5-3, and tp. 17-6-3. Retracement of tp. 26-8-3, tp. 26-9-3 and tp. 26-10-3. Miscellaneous surveys in tp. 13-26-2, tp. 17-1-3, tp. 32-5-3, tps. 31 and 32-6-3, tp. 25-10-3 and tps. 25 and 26-11-3.
Fawcett, S. D.	Ottawa, Ont.	Subdivision of tps. 77 and 80-16-6, tps. 77, 78 and the eastern two-thirds of tp. 80-17-6. Survey of the east outline of tp. 79-18-6. Stadia surveys in tp. 81-16-6, tp. 79-17-6 and tp. 78-18-6.
Fletcher, J. A.	Fletcher, Ont.	Survey of the 24th and 25th base lines across ranges 1 to 17 west of the Fifth meridian. Resurvey of the 24th and 25th base lines across range 25, west of the Fourth meridian.
Fletcher, W. A.	Thornton, Ont.	Stadia surveys in tp. 26-33-Pr., tp. 26-1-2, tp. 26-2-2, tp. 33-9-2, tps. 27, 31, 32 and 33-10-2, tps. 27, 28 and 32-11-2, tps. 27 and 28-13-2, tps. 27, 28 and 29-14-2, tps. 27, 28 and 29-15-2, tps. 27, 28 and 29-16-2, and tps. 28, 29 and 30-17-2.
Fontaine, L. E.	Lévis, P.Q.	Inspection of survey work performed during 1915 by Messrs. A. E. Glover, D.L.S., A. Lighthall, D.L.S., D. F. McEwen, D.L.S., and H. E. Pearson, D.L.S.
Galletly, J. S.	Oshawa, Ont.	Subdivision in tps. 59 and 60-23-Pr., tps. 58, 59 and 60-24-Pr., tp. 55-27-Pr., tp. 55-28-Pr., tp. 55-29-Pr. and tp. 56-30-Pr. Miscellaneous surveys in tps. 55 and 56-26-Pr.
Gibbon, Jas.	Vancouver, B.C.	Subdivision in tps. 3 and 4-29-6, tp. 3-30-6, tps. 1 and 2, W.C.M., and tps. 7 and 14, E.C.M. Miscellaneous surveys in tps. 17 and 22, E.C.M. Traverse in tps. 3 and 4-29-6, tp. 3-30-6, and tps. 14 and 17, E.C.M.
Glover, A. E.	Edmonton, Alta.	Subdivision of tps. 71 and 72-20-5, tps. 71 and 72-21-5, and part of tp. 72-19-5. Survey of the east outlines of tps. 69 and 70-20-5 and tps. 69 and 70-21-5.
Heathcott, R. V.	Edmonton, Alta.	Subdivision of tp. 85-24-5, tp. 85-25-5, tp. 85-26-5, tps. 83, 84 and 85-1-6, tp. 83-2-6 and the north third of tp. 82-2-6.
Herriot, G. H.	Souris, Man.	Survey of the 15th base line from the NE. cor. sec. 35, tp. 56-4-Pr.to the NE. cor sec. 35, tp. 56-21-Pr. Resurvey of the 15th base line from the NE. cor. sec. 35, tp. 56-21-Pr. to the Second meridian. Survey of the east outlines of tps. 57, 58, 59 and 60-21-Pr. Survey of the line between Birch Indian reserve No. 27 and tp. 56-20-Pr. and tp. 56-31-Pr.
Hubbell, E. W.	Ottawa, Ont.	Inspection of work performed during the season of 1915 by Messrs. J. C. Baker, D.L.S., R. H Knight, D.L.S., J. W. Pierce, D.L.S., and W. H. Waddell, D.L.S. Miscellaneous surveys in tp. 91-9-4 and tp. 91-10-4.
Johnston, J. H.	Peace River Crossing, Alta.	Subdivision of tps. 83, 84, 85 and 86-19-5; part subdivision of tps. 82 and 87-19-5 and tp. 84-20-5. Stadia surveys in tp. 83-18-5 and tp. 83-19-5.
Johnston, W. J.	St. Catharines, Ont.	Subdivision in tp. 24-1-6, tp. 23-2-6, tp. 23-4-6 tp. 23-6-6, tp. 22-7-6, tp. 18-8-6, tp. 20-9-6, tps. 18, 21, 22 and 23-10-6, tps. 22 and 23-11-6 and tp. 22-12-6. Traverse in tp. 24-1-6 tps. 21, 22 and 23-10-6, tp. 23-11-6 and tp. 22-12-6.
Knight, R. H.	Edmonton, Alta.	Subdivision surveys in tps. 81, 83 and 84-6-4 and tps. 84, 85, 86, 87 and 88-7-4. Survey of the east outline of tp. 82-6-4. Stadia surveys in tp. 86-8-4.

SCHEDULE of Surveyors employed and work executed by them—*Continued.*

Surveyor.	Address.	Description of Work.
LeBlanc, P. M. H.	Ottawa, Ont.	Subdivision of tp. 108-5-5, tp. 107-14-5, tp. 106-15-5, tps. 108 and 109-17-5, and tp. 109-18-5. Part subdivision of tps. 102 and 103-9-5, tps. 104 and 109-10-5, tps. 108 and 109-11-5, tps. 108 and 109-12-5, tps. 104 and 108-14-5, tps. 107 and 108-15-5, tp. 108-16-5 and tp. 108-18-5. Survey of the east outlines of tps. 101 and 104-9-5, tp. 101-10-5, tp. 105-14-5, tp. 105-15-5, and tp. 105-16-5. Traverse in tp. 109-13-5, tp. 106-14-5, tp. 106-16-5 and tp. 107-17-5. Survey of Tall Cree Indian reserves Nos. 173 and 173A in tps. 102 and 103-9-5 and tp. 104-10-5.
Lighthall, A.	Vancouver, B.C.	Subdivision of tp. 65-6-5, tps. 63, 64 and 65-7-5, and tps. 61 and 62-8-5. Survey of the east outlines of tps. 63 and 64-9-5
Lonergan, G. J.	Buckingham, P.Q.	Inspection of work performed during the season of 1915 by Messrs. L. Brenot, D.L.S., J. A. Buchanan, D.L.S., T. A. Davies, D.L.S., H. S. Day, D.L.S., S. D. Fawcett, D.L.S., J. H. Johnston, D.L.S., R. V. Heathcott, D.L.S., and G. A. Tipper, D. L.S. Miscellaneous surveys in tp. 81-21-5 and tps. 78, 79 and 80-22-5.
Martindale, E. S. (See G. W. Coltham.)	Aylmer, Ont.	Stadia surveys in tps. 44 to 48-1-4, tps. 43 to 47-2-4, tps. 42 to 48-3-4, tps. 44 to 47-4-4, tps. 46 and 47-5-4, tps. 46, 47, 48 and 54-6-4, tps. 46, 47, 53, 54 and 55-7-4, tps. 46, 47 and 52 to 57-8-4, tps. 46 to 49, 53, 55, 56 and 57-9-4, tps. 48, 49 and 56 to 60-10-4, and tps. 57, 59 and 60-11-4.
McEwen, D. F.	Hensall, Ont.	Subdivision of tp. 72-15-5, tp. 72-16-5 and tp. 72-17-5. Part subdivision of tp. 72-13-5, tp. 71-14-5, tp. 71-15-5, tp. 71-16-5 and tp. 71-17-5.
McGarry, P. J.	Merritton, Ont.	Subdivision in tps. 6 and 7-24-6, tps. 7, 8, 9 and 10-23-6, tps. 8 and 9-22-6, tps. 1 and 2-27-6, tps. 1 and 2-28-6 and tp. 1-29-6. Traverse in tps. 7, 8, 9 and 10-23-6, tp. 2-27-6, tp. 1-28-6 and tp. 1-29-6.
McKay, R. B.	Vancouver, B.C.	Latitude observations in tp. 28-5-E, tp. 16-7-E, tp. 25-9-E, tp. 74-1-Pr., tp. 36-5-Pr., tp 60-21-Pr., tp. 32-1-2, tp. 32-1-3 and tp. 32-1-4.
McKnight, J. H.	Simcoe, Ont.	Stadia surveys in tp. 33-12-2, tps. 32-33, 37 and 38-13-2, tps. 36 to 39-14-2, tps. 36 to 41-15-2, tps. 37 to 40-16-2, tps. 38 to 41-17-2, tps. 39 and 41-18-2, tps. 34, 35 and 41-19-2, tps. 33 and 34-20-2, and tp. 34,21-2.
McMaster, W. A. A.	Prince Albert, Sask.	Partial resurvey of Prince Albert settlement.
Narraway, A. M.	Ottawa, Ont.	Resurvey of tp. 12-18-3, tp. 22-19-3, tp. 9-20-3, tp. 11-25-3, tp. 13-26-3, and tps. 13 and 14-29-3. Retracement of tp. 16-22-3 and tp. 13-23-3. Miscellaneous surveys in tps. 22 and 23-18-3, tp. 21-19-3, tp. 13-22-3, tps. 12 and 16-23-3, and tps. 10 and 11-26-3. Investigation of the 3rd correction line in ranges 16, 17 and 18, west of the Fourth meridian.
Neelands, R.	Hamiota, Man.	Stadia surveys in tp. 38-21-2, tps. 38 to 40-22-2, tps. 37, 38 and 43 to 45-23-2, tps. 38 and 41 to 45-24-2, tps. 36 to 38 and 42 to 44-25-2, tps. 37, 38 and 42 to 44-26-2, tps. 36, 37, 38 and 43-27-2, tps. 37 and 28-28-2, tps. 43 to 45-1-3, tps. 43 to 45-2-3, tp. 47-3-3, tp. 46-4-3, tp. 44-6-3, tps. 43 to 45-7-3, tps. 43 to 45-8-3, and tps. 44 and 45-9-3.
Norrish W. H.	Ottawa, Ont.	Subdivision in tps. 4 and 6-2-7, tp. 6-3-7, tp. 6-4-7, and tp. 21, E.C.M. Traverse in tp. 6-2-7, Subdivision of villa lots at Woodhaven in fractional tp. W. of tp. 39, W.C.M. Triangulation along Stave lake to locate position of north limit of railway belt.

SESSIONAL PAPER No. 25b

SCHEDULE of Surveyors employed and work executed by them.—*Continued.*

Surveyor.	Address.	Description of Work.
Palmer, P. E.	Ottawa, Ont.	Stadia surveys in tps. 21 and 32-24-2, tps. 21 to 24, 27 and 32 to 34-25-2, tps. 21 to 23 and 25 to 34-26-2, tps. 21 and 28 to 33-27-2, tps. 22, 23 and 28 to 33-28-2, tps. 23, 25 and 29 to 33-29-2, tps. 28 to 30-1-3, tps. 28 and 30-2-3, tp. 24-3-3 and tp. 24-4-3. Miscellaneous surveys in tp. 27-27-2, tps. 24, 25 and 27-28-2, tps. 22, 24 and 28-29-2 and tps. 21 and 27-1-3.
Pearson, H. E.	Edmonton, Alta.	Subdivision of tp. 72-20-4, tps. 72 and 73-21-4 and tp. 73-22-4. Part subdivision of tp. 70-20-4, tp. 73-23-4, tp. 73-24-4 and tp. 73-25-4.
Pierce, J. W.	Pembroke, Ont.	Subdivision of tps. 100 and 101-9-4 and tps. 98 and 99-10-4. Part subdivision of tp. 99-9-4 and tps. 97 and 100-10-4. Correction survey in tp. 91-9-4.
Plunkett, T. H.	Meaford, Ont.	Survey of the 11th base line across ranges 10 to 15, the 12th base line from lake Winnipeg to the NE. cor. sec. 33, tp. 44-16-Pr. and the east outlines of tps. 43 and 44-11-Pr. and tps. 45, 46, 47 and 48-13-Pr.
Purser, R. C.	Ottawa, Ont.	Retracement surveys in tp. 48-22-3, tp. 45-23-3, tps. 20, 52 and 53-1-4, tp. 20-2-4, tp. 31-15-4, tp. 31-21-4 and tp. 31-22-4. Correction surveys in tps. 35 and 36-15-3, tp. 38-16-3, tps. 57 and 58-5-4, tp. 38-8-4, tp. 52-19-4, tp. 55-23-4 and tp. 53-27-4. Miscellaneous surveys in tp. 36-14-3, tp. 43-1-4, tp. 43-3-4, tp. 28-5-4, tp. 39-9-4, tp. 41-12-4, tps. 34, 36 and 53-16-4, tp. 55-22-4 and tp. 53-4-5. Traverse in tps. 61 and 62-27-4.
Rinfret, C.	St. Stanislas, P.Q.	Stadia surveys in tps. 12 and 13-4-2, tp. 13-5-2, tps. 11, 12 and 15-9-2, tps. 11 to 17-10-2, tps. 11 to 14 and 16-11-2, tps. 11 to 15-12-2, tps. 11 to 16-13-2, tps. 11 to 17-14-2, tps. 11 to 17-15-2, tps. 11 to 16-16-2, tps. 11 to 16-17-2, tps. 3 and 11 to 16-18-2, tps. 2 to 4 and 11 to 17-19-2, tps. 4 and 11 to 16-20-2, tps. 13 to 16-21-2, tps. 10 to 16-22-2, tps. 9 to 16-23-2, tps. 11 to 16-24-2 and tps 10 to 12-25-2. Miscellaneous survey in 9-24-2.
Roberts, O. B.	Kingston, Ont.	Stadia surveys in tps. 23, 31 and 32-29-3, tps. 23 to 28 and 30 to 33-1-4, tps. 22 to 34-2-4, tps. 22 to 27 and 29 to 33-3-4, tps. 23 to 32-4-4, tps 23 to 31-5-4, tps. 23 to 28 6-4, tps. 23 to 27-7-4, tps. 23 to 27-8-4, tps. 25 and 26-9-4, and tp. 40-22-4.
Rolfson, O.	Walkerville, Ont.	Subdivision of tps. 35, 36 and 37-15-Pr., tps. 37 and 38-16-Pr., tps. 37 and 38-17-Pr. Part subdivision of tps. 34 and 38-15-Pr. Survey of the east outlines of tps. 39 and 40-16-Pr. Stadia survey in tp. 38-18-Pr.
Scott, W. A.	Galt, Ont.	Subdivision of tps. 13 and 14-15-E; and tp. 13-16-E. Part subdivision of tp. 15-15-E and tp. 13-17-E. Traverse in tp. 12-15-E. Stadia surveys in tps. 14 and 15-16-E. and tp. 12-17-E.
Seibert, F. V.	Edmonton, Alta.	Survey of the 27th base line between the Fourth and Fifth meridians. Survey of the east outlines of tps. 103 and 104-9-4 and part of tp. 105-9-4.
Soars, H. M. R.	Edmonton, Alta.	Stadia surveys in tps. 50, 54, 55 and 59-17-4, tps. 50 and 57 to 59-18-4, tps. 49 to 51 and 57 to 59-19-4, tps. 50, 51, 53, 54 and 58-20-4, tps. 48 to 51, 53 and 54-21-4, tps 47 to 54-22-4, tps. 48 to 54-23-4, tp. 51-24-4, tp. 51-2-5, and tps. 51 and 58-3-5.

SCHEDULE of Surveyors employed and work executed by them—*Concluded.*

Surveyor.	Address.	Description of Work.
Stewart, N. C.	Nelson, B.C.	Subdivision in tp. 26-15-5, tps. 24 and 25-16-5, tps. 26 and 27-20-5, tps. 24 and 27-21-5, and tps. 27, 28 and 29-22-5. Traverse in tps. 26 and 27-20-5, tp. 27-21-5, tps. 27, 28 and 29-22-5, and tp. 28-23-5. Triangulation and retracement surveys in tp. 24-21-5 and tp. 24-22-5.
Street, P. B.	Toronto, Ont.	Part subdivision of tp. 73-2-Pr., tps. 72 and 73-3-Pr., tps. 71 and 72-4-Pr., tps. 70 and 71-5-Pr. and tp. 70-6-Pr. Survey of the east outline of tp. 72-6-Pr.
Stuart, A. G.	Buckingham, P.Q.	Retracement of the 9th base from the Second to the Fifth meridian, the Fourth meridian from the NE. cor. tp. 51-1-4 to the NE. cor. sec. 1, tp. 62-1-4, and the Fifth meridian from the NE. cor. tp. 14-1-5 to the NE. cor. tp. 32-1-5.
Taggart, C. H.	Kamloops, B.C.	Subdivision in tps. 17 and 18-11-6, tp. 17-12-6, tps. 17 and 18-13-6, tp. 19-14-6, tps. 18 and 20-15-6, tp. 22-17-6, and tp. 19-18-6. Miscellaneous survey in tps. 19 and 20-19-6. Traverse in tp. 18-15-6, tp. 19-18-6 and tp. 17-12-6.
Tipper, G. A.	Brantford, Ont.	Subdivision of tp. 77-4-6, tp. 76-6-6, and tp. 77-7-6. Part subdivision of tp. 77-6-6 and tps. 76 and 78-7-6.
Tyrrell, J. W.	Hamilton, Ont.	Part subdivision of tps. 34 and 35-5-Pr., tps. 30, 34 and 35-6-Pr., and tps. 33, 34 and 35-7-Pr.
Waddell, W. H.	Edmonton, Alta.	Part subdivision of tp. 80-6-4, tps. 76, 77 and 78-7-4, tps. 75, 76 and 77-8-4, tps. 73, 74, 75 and 76-9-4, and tp. 73-10-4.
Walker, C. M.	Banff, Alta.	Miscellaneous surveys in tp. 4-10-E., tp. 3-12-E., tp. 18-20-Pr., tp. 3-22-Pr., tp. 16-4-3, tp. 15-5-3, tp. 16-5-3, tps. 18 and 20-6-3, tps. 15 to 18-7-3, tps. 19 and 20-15-3, tps. 10 and 12-16-3, tp. 18-18-3, tp. 18-19-3, tps. 12 and 14-22-3, tp. 11-23-3, tp. 13-28-3, tp. 1-26-4, tp. 22-5-5 and tp. 26-12-5. Levelling contour survey and subdivision of St. Julien addition to townsite of Banff. Miscellaneous surveys at Banff.
Wallace, J. N.	Calgary, Alta.	In charge of precise and other levels, including lines of levels along the G.T.P. railway from Portage la Prairie to Goodeve, and along the C.N. railway from Saskatoon to Rosebud; a line from Grouard through Peace River Crossing to Dunvegan; a line from Desjarlais ferry on North Saskatchewan river to Cold lake, and about 200 miles of short lines and branches from the above.
Weld, W. E.	Ottawa, Ont.	Subdivision in tp. 48-13-Pr. and tp. 48-14-Pr. Survey of addition to Grand Rapids settlement at the mouth of Saskatchewan river.

APPENDIX No. 2.

SCHEDULE showing for each surveyor employed the number of miles surveyed of section lines, township outlines, traverses of lakes and rivers and resurvey, also the cost of the same. Surveyors whose work cannot be reckoned in miles are omitted from the statement.

Surveyor.	Miles of section.	Miles of outline.	Miles of traverse.	Miles of resurvey.	Total mileage	Total cost.	Cost per mile.
						$	$ cts.
Akins, J. R.		241			241	24,775	102 80
Aylsworth, C. F.			51	221	272	8,418	30 95
Baker, J. C.	236	102	133		471	15,701	33 33
Bennett, G. A.			340	131	471	5,514	11 71
e Blanchet, G. H.		128		1	129	11,647	90 29
Boulton, W. J.			564	12	576	5,067	8 79
Bowman, E. P.			440	34	474	5,695	12 02
Brenot, L.	265	52	42		359	15,668	43 64
Buchanan, J. A.	300	54	58		412	14,210	34 49
Calder, J. A.	138		11	2	151	9,177	60 77
e Christie, W.	363	53	31	7	454	10,407	22 92
a Christie, W.				35	35	1,669	47 68
d Coltham, G. W.			155	12	167	2,020	12 09
Cote, J. M.				405	405	9,774	24 13
Cowper, G. C.			294	84	378	5,313	14 06
Cumming, A. L.	188	37	47	8	280	10,312	36 83
Davies, T. A.	276	42	27		345	13,285	38 50
Day, H. S.	240	66	38		344	14,501	42 15
Evans, S. L.			3	519	522	8,870	16 99
Fawcett, S. D.	279	42	88		409	14,488	35 42
e Fletcher, J. A.		204		9	213	28,007	131 49
Fletcher, W. A.			484	62	546	4,946	9 05
c Galletly, J. S.	177	53	116		346	11,674	33 74
Gibbon, Jas.	71		34	37	142	9,049	63 73
Glover, A. E.	264	74	66		404	14,426	35 70
c e Herriot, G. H.		126		62	188	14,404	76 61
Heathcott, R. V.	391	36	28		455	14,303	31 43
Johnston, W. J.	107		14	19	140	8,874	63 39
e Johnston, J. H.	340	81	39		460	14,489	31 49
Knight, R. H.	209	126	46		381	14,269	37 45
b LeBlanc, P. M. H.	501	198	167	4	870	35,422	40 71
e Lighthall, A.	360	90	61		511	13,891	27 18
Martindale, E. S.			294	8	302	3,618	11 98
McEwen, D. F.	376	62	124		562	13,395	23 83
McGarry, P. J.	89		44	13	146	10,005	68 53
McKnight, J. H.			577	8	585	5,479	9 37
Narraway, A. M.				630	630	10,076	15 99
Neelands, R.			526	129	655	5,116	7 80
Palmer, P. E.			238	75	313	5,193	16 59
Pearson, H. E.	409	44	49		502	13,278	26 45
Pierce, J. W.	340	126	160	2	628	16,631	26 48
e Plunkett, T. H.		106			106	16,529	155 94
Rinfret, C.			182	113	295	4,642	15 73
Roberts, O. B.			390	92	482	5,642	11 70
Rolfson, O.	298	72	188		558	13,074	23 43
e Scott, W. A.	214	46	210		470	13,888	29 55
e Seibert, F. V.		157			157	21,202	135 04
Soars, H. M. R.			523	2	525	5,387	10 26
Stewart, N. C.	64		81	8	153	8,947	58 47
Street, P. B.	134	50	74		258	8,345	32 35
e Stuart, A. G.				677	677	9,256	13 67
Taggart, C. H.	101		2	20	123	9,106	74 03
Tipper, G. A.	306	30	39		375	14,457	38 55
Tyrrell, J. W.	254	83	86		423	10,584	25 02
c Waddell, W. H.	234	144	70		448	14,700	32 81
Total	7,524	2,725	7,234	3,441	20,924	628,815	30 05

a Base line resurvey.
b Includes work of two seasons.
c Estimate only; final returns not yet in.
d Taken ill; work taken over by E. S. Martindale.
e Total cost includes cost of levels.

REPORTS OF SURVEYORS

APPENDIX No. 3.

ABSTRACT OF THE REPORT OF J. R. AKINS, D.L.S.

SURVEY OF THE SIXTH MERIDIAN NORTH OF TOWNSHIP NINETY.

My instructions for the season of 1915 called for the survey of the Sixth meridian from township 90, northerly as far as it could be conveniently run in one season. I accordingly left Edmonton with my party on March 26, and proceeded by train to Reno and thence by trail to Peace River Crossing.

I expected to be able to get the party to the work on sleighs but found the snow all gone, very little frost in the ground, and the ice becoming dangerous on the river. Teams were hired, therefore, to take the party as far as possible in wagons, the route followed being along the Bear Lake and Whitemud River trail. When Whitemud river was reached it was found to be open and we were unable to proceed farther with wagons. The pack-train had therefore to be used for the remainder of the distance.

Work was begun on April 9, but was considerably retarded for the first week while the supplies were being brought up. Enough supplies were taken along to last for two months; by that time we expected to be far enough north to obtain more at Keg river, where by previous arrangement three months' supplies were being cached. Arrangements were also made to have the supplies for the latter part of the season placed at Hay River post. These were to be freighted from Fort Vermilion over a wagon trail which runs in a northwesterly direction for about one hundred miles to Hay river. This trail is very good for fifty or sixty miles from Fort Vermilion. The remainder is fair, the worst part being around Hutch lake, where it is very stony.

After the first week the work progressed very rapidly and the 27th base was reached on June 21. In 1913 this base had been surveyed to within sixteen miles of the Sixth meridian, and as the closing of the levels on this line with those on the meridian were very much desired it was decided to run the unsurveyed portion of the base line before continuing work on the meridian. This was completed on July 5.

The month of July is always considered by surveyors as the most trying of the year, but this season it was more than usually so for us. From the second crossing of Chinchaga river in township 104, until Negus creek was reached in township 112, a distance of about sixty-five miles, including sixteen miles of the 27th base, only one running creek was crossed and that a very small one. The reason for this was that the season was very dry and the work lay along the divide between the waters of Chinchaga and Boyer rivers. Wells were dug but the water thus obtained was very alkaline. This had a bad effect on both men and horses, as one of the horses died and several of the men became ill.

On August 10, the meridian had reached the 29th base. This base had been run the previous year, but only temporary monuments had been erected across the last range. This range was rerun and permanent monuments were established.

Very little rain had fallen during the summer, and towards the end of July fires began to cause much trouble and annoyance. Large fires were burning to the north, south, east, and west of camp, so that at times the sun was not seen throughout the day because of the dense clouds of smoke, and showers of ashes were continually falling on the camp. This at times made the party very nervous, and on August 9 my cache was burnt. On the 17th the trail locater discovered along Hay river, a large fire which horses could not get through. The party was then camped on a

small creek in the midst of heavy windfall and long grass, and considerable uneasiness was felt lest the wind should rise and sweep the fire over camp before a trail could be found around it. By making a detour to the west a trail was found around the fire to Hay river, and camp was moved as quickly as possible, but wind had risen the night previous to moving, and although the horses were on the trail about daylight, the fire had already crossed it in several places. As these were not very wide the horses were galloped through them without injury. The same day the line and fire met and the men were compelled to quit work on account of the heat and smoke. The second night after this a light shower dampened the fire sufficiently to allow the line to be surveyed through it and across Hay river. No more fires were encountered, but the smoke was troublesome for some time.

Twenty miles south of Hay river horse feed began to get scarce, and north of township 120 none was to be found. Man-packing was resorted to in order to complete the last twenty-two miles of line.

On October 8, it was decided to quit work on the meridian and turn back, as the season was advancing and there was a long trip home; also the fall appeared to come a month earlier in that latitude than at Peace River Crossing.

It had been our intention, on the return trip, to follow the trail that had been made while producing the meridian, and small caches had been left at intervals along this trail for use on the home trip, but on reaching Hay river we were informed that the country to the south was all burnt, the feed gone, and the trail blocked with windfall. It was therefore necessary to return by the Fort Vermilion trail to where Keg River trail branches from it westward. This is at an Indian village called Alaska, and is about thirty miles west from Fort Vermilion. From this point the Keg River trail was followed to Keg River post. This was much longer than the meridian trail.

On October 21, the day on which the party reached Hay River post, about a foot of snow fell, and it continued to fall in light quantities for several days. We were met at Hay River post by some freighters who had brought supplies in wagons from Fort Vermilion. These were engaged to take the baggage to Alaska, as it was considered advisable to spare the pack-horses as much as possible. The roads were very heavy, however, and as the horses were without oats they gave out after the first day and were sent back. I put ten hundred pounds in one of the wagons, and brought it along with my big team, and what was left was brought by the pack-train.

Alaska was reached on the 28th, and the services of four Indians with their teams were secured to take the outfit to Keg River post. They made very little better time than the pack-train, as they carried no oats for their horses, and these had to "rustle" for their feed in the snow, which in places had attained a depth of eighteen inches. We arrived at Keg River post on November 4, and from there to Peace River Crossing we had to depend on the pack-train. The trail was quite heavy as far as Whitemud river, but south of that the ground was bare. Peace River Crossing was reached on the 17th after thirty-five days of actual travelling from the end of the line. Trail had to be broken for the greater part of the distance through snow from eight to eighteen inches deep. The average distance travelled per day was about twelve miles, which is a good day's work for a loaded pack-train working continuously.

The total number of miles run during the season was 241. Two hundred and eighteen miles of this was on the meridian, which is now surveyed about two miles north of the north boundary of the province of Alberta. Levels and check levels were taken along the lines, and vertical angles were read by the transit from one station to another to check the leveller in case of any large error.

South of Hay river the following method of chaining was adopted: a new device was used by which, during the measuring, the chain was suspended freely; the slope angles were read by the transit; a constant strain was applied which was measured by a spring balance and corrections made for stretch and sag and the temperature of

each stretch was taken by a Casella thermometer which was fastened to a leg of the tripod. The conditions north of Hay river were not suited to the continuation of this method.

The season's work began at the northeast corner of section 36, township 90, and Battle or Notikewin river was crossed about four and a half miles north. This river is from sixty-six to one hundred feet wide, and from two to eight feet deep. It rises in Clear hills and flows northeasterly into Peace river. It has two large branches, Hotchkiss and Meikle rivers, both of which are nearly as large as the main branch. Meikle river has also a large branch, Botha river. Locally these are all called Battle rivers. Along these streams are some good flats and hay meadows which, in their present condition, would supply feed for a large amount of stock. The soil along the rivers is nearly all suitable for farming but the best flats are found on Notikewin river. About fifteen miles east of the meridian these flats have enlarged to such an extent that they are called the Notikewin river prairie; this is reported to be a fine open piece of country but not very large. The divides between the rivers are low, and generally wooded with spruce, poplar, and willow, but there is very little good timber.

About ten to twelve miles west of the line the country becomes hilly. These hills are a continuation of the Clear hills and extend far to the north forming the divide between Hay and Liard rivers. All the rivers flowing across the meridian, together with Hay river and its tributaries, have their sources in these hills. These hills are reported to be covered with moss and small spruce, the greater part of which has been burnt, and many lakes are located on them. A range of hills also extends across the meridian forming the divide between Notikewin and Keg rivers. It commences about two miles north of township 98, and extends to about the middle of township 101. The summit, which was reached about two miles south of the north boundary of township 98, has an elevation of about 2,790 feet, the highest elevation found during the season. There is very little horse feed on this range.

The line crosses Keg river about the middle of township 101. This stream is about forty feet wide, two feet deep, and flows a little to the north of east, entering Peace river a short distance below Carcajou point. The country is wooded where the river crosses the meridian, but about four miles east of the line Keg River post is located in a beautiful prairie called Keg River prairie. It contains four or five townships of as fine prairie land as one could wish to see, and is exceptionally suited for stock raising, as nowhere in the West does wild vetch and blue-joint grow in greater abundance. Grain cannot be raised very successfully at present because of the frosts. Revillon Frères and the Hudson's Bay company have trading posts at Keg River, and several settlers have squatted there during the past summer. A wagon road runs from the prairie to Carcajou point on Peace river, and also one to North Vermilion. There is much open country along these trails, but the trails are not very good. The wagon road from Peace River Crossing to Bear lake and Notikewin river prairie is now within seventy-five miles of Keg river. When this is cut through, which will probably be in the near future, there will be a wagon road from Peace River Crossing to North Vermilion. A wagon road also leads from Keg River post to Chinchaga river. This river crosses the line about the centre of township 102, and flows northeasterly for several miles, then northwesterly crossing the line again at the southeast corner of township 104. Its farthest point east is about six miles from the meridian. After crossing the meridian the second time it flows in a northwesterly direction until it enters Hay river. There is a good area with fine grass close to the river, but the grass does not extend far back from it. The junction with Hay river is in the vicinity of the 29th base and perhaps twenty miles west from the meridian. This stream is always spoken of by the settlers as Hay river, but is shown on some of the old maps as Chinchaga river, which was the name Mr. Wm. Ogilvie, D.L.S., obtained from the Indians for it when he made the trip in 1891 from Liard river to Fort St. John. I was told by trappers at Fort Vermilion that the Indian name for this river means "big wood," and that it was so named because years ago the country

along it was wooded with large spruce. Small areas of this timber are still growing on points along the river, but the greater part has been destroyed by fire. Where it is still growing the spruce is the finest that I have ever seen. They have few limbs, and grow very straight to about one hundred feet in height, and taper very slowly from the ground, being nearly as thick fifty feet up as they are four feet from the ground. They were seen up to thirty inches in diameter.

A sketch map, prepared by the British Columbia Government from exploratory surveys, made in 1913-1914, of the northeast portion of Peace River district, shows Hay river as crossing the British Columbia-Alberta boundary about twenty miles south of the 59th parallel of latitude, or about one mile north of township 111. As it crosses the meridian about one mile south of the north boundary of township 114, its general direction is a little north of east. It continues in this direction to Hay River post, after which the course is more north than east. Hay River post is about the north boundary of township 115, and about nine miles east of the meridian. Revillon Frères and the Hudson's Bay company have stores on the south side of the river. These stores open about the middle of October each year, and remain open until spring.

Hay river is quite a large stream during high water, having a width of about 100 yards, and a depth of from four to ten feet, but in the fall the water is very low so that in many places it can be forded with the water not above the knees. A good pack-trail on the north side of the river leads from Hay River post to Adair creek, which it follows for about twelve miles westward from the meridian. From there it swings southwest to Hay lake. Hay river does not run out of Hay lake, but is joined to the lake by a creek. A strip of fine grass land extends along Adair creek: this strip, however, is narrow, and it was the only good country seen north of Hay river.

From Hay river to the northern part of township 120, the country is very level and soft, with numerous bogs, sloughs, and muskegs. The Indians say that somewhere about township 120, and about eighteen miles west of the meridian, there is a large lake, the waters of which flow into Liard river. This would appear to be the same lake that the Nelson Indians told Mr. Ogilvie about, and which they called Bistche lake. The Hay River Indians say that no white man was ever on the lake, and that it takes them from early in the morning until long after dark to go from one end of it to the other with dogs: this would indicate a distance of forty or fifty miles. They also say that in one place it is very narrow with shores of steep solid rock. One of the Indians said he had seen a ribbon of stuff the color of gold running through one of these rocks. It would make a very interesting trip to cross from Hay river to the Liard, as it has never yet been done by a white man.

In township 120 Cutknife mountains were reached. The country rises quickly from the south boundary of the township, which has an elevation of 1,349 feet, to the highest point at the north boundary of township 122 where the elevation is 2,529 feet; this is a rise of about 1,200 feet in eighteen miles. From this point northward the country is level or rolling with an elevation of 2,233 feet at the end of the line.

The water north of township 122 all flows northwestward, probably into Liard river. The top of Cutknife mountains is covered with moss and a growth of stunted spruce. The age of one of these spruce that had a diameter of about four inches, was found to be 133 years. The frost in many places never goes out of the ground, the moss preventing the heat from entering the soil. Below the moss is gravel.

There are many lakes in this district some of which are of considerable size. Beatty lake which is just west of the meridian in township 125, is about six miles long and about four wide. These lakes have stony bottoms and shores, and contain many fish.

The Indians living around Hay river belong to the Slavey tribe. They cannot understand Cree nor can a Cree Indian understand their language. Near the end of the line a hunting party of Indians from Providence was seen.

There are many bears, moose, jumping deer, and caribou in the country passed over during the season. The best hunting ground is on Notikewin river and its tributaries. The caribou live north of Hay river. It appears that in the past, game was much more plentiful north of Hay river than now, as there are numerous paths that have been cut deep in the moss. The burning of the country has had much to do with scattering the game. There are many fur-bearing animals along the country travelled over and Hay River post is considered one of the best fur posts the trading companies have. Very few grouse were seen, but there were many geese and ducks on the rivers and lakes.

There was no rock found in place nor any mineral.

APPENDIX No. 4.

ABSTRACT OF THE REPORT OF C. F. AYLSWORTH, D.L.S.

MISCELLANEOUS RESURVEYS IN MANITOBA AND EASTERN SASKATCHEWAN.

On April 29, I left Winnipeg with my party and proceeded to tp. 12-9-E, where we resurveyed the north boundary of the township. The northern part of this township is mostly sand and gravel and is of little value as agricultural land. A good wagon road leads from Molson to the northeast corner of section 34.

We next moved into tp. 12-10-E., to complete the retracement of the western part of the township left unfinished in 1914; this was completed on May 19. Sections 11, 12, 13, and 14 of this township also required retracement but Julius muskeg in the centre of the township was found to be impassable for wagons or horses. We therefore returned to Molson and secured a hand-car, which we used on the Canadian Pacific railway for travelling back and forth to these sections. This work was completed on the 26th.

Our next work was the retracing of that part of tp. 26-30-Pr., lying north of Assiniboine river. These sections lie principally along the edge of the river valley, and the work was consequently rough. The land in the bottom of the valley is very rich and easily cleared.

On June 17, we moved to tp. 23-31-Pr., where all the lines in the township were retraced. There are a few Icelanders in this district, but most of the settlers are Germans. They appear to be fairly prosperous, although a number of the homesteads have been abandoned. The greatest drawback is the difficulty of obtaining water.

On July 17, this survey having been completed, we proceeded to section 3, tp. 29-31-Pr., and from this place as a camp we retraced the north boundary of tp. 28-31-Pr., and the boundaries of several sections adjoining this line. There are two Doukhobor villages in the section where our camp was located, but only about half of the houses in these villages are now occupied, as many of the people are living on their own homesteads. They are erecting substantial buildings and are quickly becoming Canadianized.

On August 30, we began the retracement of the west halves of tps. 24 and 25-27-Pr. These half townships lie just west of Riding Mountain Forest reserve, and have been overrun by fire many times. They are covered with a thick growth of peavine, and would appear to be well suited for mixed farming. Although only recently thrown open for settlement, they are nearly all homesteaded. The main line of the Canadian Northern railway crosses the northern part of township 25.

On completion of this survey I broke camp, stored my outfit, and left for home, where I arrived on October 9.

APPENDIX No. 5.

ABSTRACT OF THE REPORT OF J. C. BAKER, D.L.S.

SUBDIVISION SURVEYS IN NORTHERN ALBERTA.

The work upon which I was engaged during the season of 1915, was confined to the lands along Athabaska river, in township 94, range 10, and townships 94, 95, 96, and 97, range 11, all west of the Fourth meridian.

I left Edmonton with my party on May 7, and arrived at the mouth of Muskeg river, in tp. 94-10-4, on May 21. The route followed was by rail to Athabaska, and thence down Athabaska river by scows to our destination.

Work was commenced on May 22, and was completed, with the exception of the traverse work, on October 27. My assistant then took the majority of the party to Edmonton, where they were discharged. Five men were retained to assist with the traverse, which was completed on December 3.

The district surveyed is fairly level, with the exception of the valleys of Muskeg, McKay, and Moose rivers. These valleys vary from fifty to two hundred feet in depth, and the sides of the valleys of the two latter streams are so steep as to render the rivers of little use as sources of water supply for stock.

A cross-section of the country six miles, east, and six miles west of the Athabaska, in almost any part of the district surveyed, would show about two and a half miles of fairly level, lightly-wooded land, two miles of muskeg, sometimes very wet, and back of that higher land covered with second-growth poplar and willow. When cleared and drained most of the land in the district will be suitable for agriculture. The Indians at McKay grow garden vegetables with very little labour. There is no hay land in the district, but the muskeg will grow plenty of hay when the moss is burned off, as the soil beneath the moss is sandy loam. Large deposits of asphalt occur along the various streams in the district.

Game is quite plentiful, consisting of moose, bears, and a few deer, while fur-bearing animals, such as marten, foxes, mink, and beavers are also quite numerous.

It is expected that the new Alberta and Great Waterways railway will be completed as far as McMurray early in 1916, and this will save settlers and other travellers a hard trip by scow. Beyond McMurray the river is clear of rapids and is suitable for navigation. Last summer one or two passenger boats made monthly trips between McMurray and Chipewyan. There is a good pack-trail on the west side of the river leading from McMurray to McKay.

APPENDIX No. 6.

ABSTRACT OF THE REPORT OF M. H. BAKER, D.L.S.

MISCELLANEOUS SURVEYS IN MANITOBA, SASKATCHEWAN AND ALBERTA.

The work on which I was engaged was of such a varied and scattered nature that no regular party was organized, labourers being hired locally when needed.

Our first work was the survey of a parcel of land in tp. 15-12-E. as a site for power development for the Winnipeg Electric Railway Co. The surrounding area is wooded with poplar, spruce, balsam, and birch, and although there is considerable rock, good areas of agricultural land are interspersed. Winnipeg river has been so much deepened and cleared of rock cuts by power development works that the increased flow of water in Pinawa channel has flooded large flats of land which are now permanently covered with water.

The district along Swan river in tp. 37-26-Pr., where we made a correction survey, is partly wooded and the soil is very fertile. It is well settled and grain is the chief product.

After making a correction survey in tp. 51-3-3 and also in tp. 40-26-2 we left for Watrous, Saskatchewan to resurvey the 8th correction line across ranges 26 and 27.

In this district which is practically all taken up, wheat is raised extensively and also a considerable quantity of oats. It is close to the Canadian Pacific railway and transportation is good. Across range 26 the surface is rolling and increases in roughness until it becomes hilly on the west side of range 27, but it is not too rough for farming purposes. The land throughout this district is rather stony but the soil is of excellent quality after the stones are cleared off.

We next made corrections in tp. 27-24-2 and tp. 24-24-2 and subdivided the dried-up bed of a portion of Last Mountain lake in tp. 22-23-2. The land in this district is excellent, and large areas of wheat and oats with some flax are cultivated. Good crops are obtained every year without exception. Last Mountain lake abounds in whitefish, pickerel, and perch, and the fishing industry is being extensively developed. This district appears exceedingly prosperous.

A resurvey of blocks 4 and 11 in the townsite of Wymark, Saskatchewan, was next made and we then went to Outlook, Saskatchewan, arriving there on July 5, to make a resurvey of the E. By. sec. 13, tp. 28-7-3. This district is well developed, practically all the land being under cultivation and producing excellent crops of wheat and oats, and other grains in small quantities.

We next proceeded to Dana, Saskatchewan, where a small correction was necessary in sec. 20, tp. 38-26-2, and from there to Gilbert Plains, Manitoba, where I investigated an erroneous monument marking the quarter-section corner on the E. By. sec. 10, tp. 25-22-Pr. The latter is a very old-settled section of the country and practically all the land in the vicinity is occupied. Much of it is cleared and produces excellent crops of wheat and oats. Some mixed farming is also carried on.

From Gilbert Plains, we proceeded to Ste. Anne des Chenes, Manitoba, to survey that portion of the Dawson road extending from the east boundary of Lot 94, in the parish of Lorette to the east boundary of tp. 8-8-E. Much of this road, where surveyed, has been graded, and I understand it is the intention to grade those portions which have not already been done. Through the parish of Ste. Anne des Chenes, the lots are all settled and large areas are cultivated, wheat and oats being the chief products. There are also large areas of hay lands. Between the east boundary of the parish of

Ste. Anne des Chenes and the east boundary of township 8, range 8, much of the country is still unoccupied and is densely wooded. A few farms have been cleared, however, and good crops are raised.

I completed the survey of the Dawson road on August 16, and proceeded to Fairford, Manitoba, where I retraced lots 19 and 20 in Fairford settlement and restored lost monuments. These lots are surrounded by Fairford Indian reserve. In the surrounding country there has been very little development, most of the country being thickly wooded.

From Fairford I went to St. Laurent, and from there drove to tp. 15-4-Pr. In this township I was instructed to survey all agricultural land in sections 29, 30, 31, and 32, which had not already been surveyed. The land in these sections consists of a narrow neck separating lake Francis on the east from lake Manitoba on the west. It is bordered on the west side by a good sandy beach rising to sand dunes, and on the east side by large areas of marsh. We found but a very small area of land fit for agriculture and that was of very poor quality.

Our next work was in township 17-11-E., where we retraced several lines. This township is so thickly wooded and crossed by a number of rock ridges that no settlement has taken place yet. We then proceeded to tp. 4-17-Pr. to investigate duplicate monuments along the north boundary of section 26. This district is practically all under cultivation, and produces crops of wheat and oats principally.

The survey of a road along the north shore of Arcola lake in sec. 24, tp. 10-3-2 was our next work. This road is located in the Moose Mountain Forest reserve, Arcola lake is rapidly developing into a popular summer resort, and a number of summer residences are already built. The road from Arcola is in very bad condition and in wet weather is almost impassable for motor cars.

From Arcola, we proceeded to Huntoon, Saskatchewan, in tp. 7-10-2 where we had instructions to correct a number of erroneous monuments. This district is well settled but much of the land is held by speculators and is still unoccupied. Excellent crops are raised, chiefly of wheat and oats, but very little mixed farming is carried on.

We next proceeded to Estevan, arriving there on October 3; from there we drove to townships 1, ranges 8 and 9, west of the Second meridian where we retraced the line between ranges 8 and 9 in townships 1 and 2. Township 1 in these ranges, is well settled and large areas are under cultivation. During my visit in the district, threshing operations were being diligently prosecuted, and the yield of wheat was found to average about forty bushels per acre. The farmers in the vicinity of the international boundary ship their wheat in bond from stations on the American side of the line to Canadian ports, as they contend the roads are better for the heavy loads than the roads to Estevan. In township 2 in these ranges, the land is exceedingly rough and stony, so that very little settlement has taken place and practically no land is cultivated.

We next made a resurvey in tp. 28-18-2 and tp. 24-2-2, surveyed a cemetery at Willowbunch in tp. 5-27-2, and made a correction survey in tp. 19-8-2.

Our last work was the survey of part of tp. 44-25-Pr. This is a very difficult section of the country to reach except in winter as the trail from Mafeking crosses very wet muskeg country. There is very little land of agricultural value in this vicinity. At the mouth of Steep Rock river there is a permanent fishing camp where operations are carried on in the winter. Completing this work I left for Mafeking on October 31 and thence for my home in Toronto.

APPENDIX No. 7.

ABSTRACT OF THE REPORT OF P. R. A. BELANGER, D.L.S.

RESURVEY OF LAC LA BICHE SETTLEMENT IN NORTHERN ALBERTA.

Arriving with my party at Lac La Biche on June 25, we immediately began an investigation to ascertain whether or not a resurvey of the settlement was necessary. This was done on our way from the railway station to the west end of the settlement, a distance of about twenty miles. It was soon ascertained that a resurvey was urgently required, and work was started at once.

The original survey of the settlement had been made twenty-seven years ago and the old wooden posts were all rotted off. None of the settlers seemed to know the position of any corner or line, and it required several days' work on our part to locate a lot monument from which to start our resurvey. However, after getting a proper start we had little difficulty in finding the remains of the old posts. Seventy-five per cent of these were found, although not showing on the surface. In some cases the tops of the posts could be found lying on the ground and covered with several inches of rotted leaves or other vegetation, while in other cases only the bottoms of the posts could be found. These were usually from six to eighteen inches below the surface. In some cases old bearing trees were detected by small blisters on their sides. These blisters when reopened showed the old blazes with the letters B.T. well preserved in most cases, and at depths varying from one to three inches in the trunks of the trees.

We did not consider it necessary to retraverse lac La Biche as there had been practically no change in the shore line since the original survey. All small lakes within the settlement were retraversed, however, and all lot lines were retraced with the exception of the boundaries of lots 4, 5, and 6, which had been resurveyed several years previously. Only part of the trail through the settlement was retraced. All old wooden posts were replaced by iron ones, and the mounds were rebuilt. We also surveyed a few miles of section lines in the adjoining townships.

This work kept us busy till October 13, when we returned to Edmonton where the party was disbanded.

The settlement has been gradually going backward for the past ten years, because most of the settlers, after receiving their patents, sold their land for a few dollars to speculators, who hold it now at exorbitant prices. They do not cultivate the land, and the houses and buildings are closed and are falling to ruin. This condition cannot last very long however, as the construction of the railway is already bringing new life to the eastern part of the settlement, where the station is located. Townsites have also been laid out upon which a thriving little town is already rising, with stores and shops of all kinds. A fine hotel owned by the railway company, was nearing completion last fall; it is built in the most modern style, with the intention of supplying first-class accommodation, and making Lac La Biche an attractive place for tourists, who will find there one of the most ideal summer resorts in the province of Alberta. All along the lake are found ideal places for summer residences with fine sandy beaches, which in some places extend for a quarter of a mile into the lake, the depth of water increasing very gradually from one to four feet and affording the greatest safety for bathers. One steamboat and several gasolene and sail boats are already plying over the lake, and are kept in readiness for prospective tourists, who are expected to visit the place or make their summer homes there.

The richness of the land and the ideal climate which prevails at Lac La Biche, should make the settlement an attractive place for settlers willing to invest money on

paying farm land. They would find a ready market for their products, either by selling them to the numerous tourists who will adopt that place for their summer homes, or by supplying the northern districts extending to the Arctic ocean.

The railway is expected to be completed to McMurray this year and it should prove a great boon for the Edmonton district, which will benefit by the opening of that country to agriculture and the lumber trade.

Sportsmen will be afforded a great opportunity to enjoy good hunting and fishing excursions. They can go to McMurray by rail, and from there by canoe to any place down Mackenzie river, and return by canoe or steamboat to Peace River Crossing.

Small and large game is decreasing every year in this district. Large game is now found on the north side of the lake only. Whitefish, pike, and pickerel are still plentiful.

APPENDIX No. 8.

ABSTRACT OF THE REPORT OF G. A. BENNETT, D.L.S.

STADIA SURVEYS IN SOUTHERN SASKATCHEWAN.

My surveys for the season of 1915 consisted of the investigation and survey of water areas within the block of townships between the 7th correction line (north of township 26) and the 10th base line (north of township 36), and between ranges 16 and 29 inclusive west of the Third meridian.

I left home on May 21 and proceeded to Saskatoon where I organized my party. Field operations were commenced on May 28 in tp. 36-16-3.

In this township and those adjacent to it, many alkaline lakes were investigated and surveyed. These water areas varied from ponds just over five acres in extent to large lakes from twelve to fifteen miles in length and three to four miles in width. The depth of these lakes does not usually exceed eighteen inches, and the water usually consists of a liquid alkaline solution of hydrous sulphate of sodium, sodium chloride, and magnesium sulphate. Under this is a semifluid alkaline mud varying from three to twelve feet in depth. During periods of drought the shores become encrusted with a white efflorescence of the salts held in solution. This prevents the growth of vegetation and maintains the area of the lakes fairly constant from year to year, although they have their main source from surface drainage and have no outlet except evaporation.

The soil in this district is generally sandy or sandy loam. Almost all the land has been homesteaded and the settlers are making a success of mixed farming.

When the investigation had been completed of all the townships in the vicinity of Biggar, not previously examined, the work was continued west of Kerrobert. From June 23, until September 27, the party was engaged in the block of forty-two townships composed of townships 31 to 36, ranges 23 to 29. Many lakes were found and surveyed, almost all of which were alkaline or salty. Very few of these lakes had been previously surveyed as their area seldom exceeded twenty acres, while numerous large lakes which had been surveyed some years ago were found to have dried up, leaving their beds available for hay and pasture land. The section lines were run across these dry lake beds and monuments were erected at the section and quarter-section corners.

Three small resurveys were also made to correct errors found in the original survey of the section lines in tp. 36-24-3, tp. 36-26-3 and tp. 34-28-3.

During the summer of 1914 the crops suffered so severely from drought that very little grain was harvested and many of the settlers were threatened with ruin. The Dominion Government however came to their rescue and loaned them feed and seed grain which enabled them, not only to winter their stock, but also to sow a greater acreage in 1915. Evidence of this could be seen in the fine herds of cattle grazing in the sloughs, the quantities of dairy produce shipped by the farmers, and the large crops of wheat and oats harvested.

Our next work was in seven scattered townships, northwest of Zealandia. These townships contained very little water: only one lake was found, and the marshes and sloughs that had existed at the time of the original survey were found to have dried up, so that it was possible to erect monuments to mark the section and quarter-section corners that fell in these depressions. These townships were found to be well settled, and about half the land is under cultivation.

On October 13 we began the investigation and the necessary survey of a block of sixteen townships near the town of Kindersley on the Saskatoon-Calgary branch of the Canadian Northern railway. Almost all the water areas that existed in these townships at the time of the original survey had dried up, so that we were able to establish many monuments to mark section and quarter-section corners. These townships were in what is known as the "Goose Lake" district. This district, famous for its grain growing, broke all former records in 1915, and yields of from forty to sixty bushels of wheat, and from ninety to one hundred and twenty bushels of oats, to an acre were harvested. The grain was of excellent quality, and the quantity was so great that the Canadian Northern Railway Co. was unable to provide cars in sufficient numbers to move the crop. Some farmers built granaries of huge bins, others merely piled the grain upon the prairie. North of Fiske station we saw one such pile, from the crop of a single farmer, which was estimated to contain seventeen thousand bushels of wheat.

We next moved to tp. 35-6-3 where a traverse of South Saskatchewan river through the township was urgently required. The new survey showed that the river had altered its course very considerably since the previous survey. On the east boundary of section 11, a strip of good bench land nine chains in width had been washed away. Some difficulty was experienced in making the survey of the river at that season of the year on account of the dense willow brush which covered the banks and islands, and the treacherous quicksand found along the water's edge. On this account only the surveys urgently required were made. The party was disbanded on November 5.

APPENDIX No. 9.

ABSTRACT OF THE REPORT OF G. H. BLANCHET, D. L. S.

BLOCK OUTLINE SURVEY EAST OF LAKE WINNIPEG.

Leaving Selkirk on May 13 we went by boat to Berens and then by canoe to our starting point on Pigeon bay. We began work at the NE. cor. tp. 37-3-E. on the 17th and ran south to the 10th base line (north of township 36). We next ran the 10th base east across ranges 4, 5 and 6, and then surveyed the east outline of range 6 south of the 9th base line (north of township 32).

The east outline of tp. 37-3-E cuts off Pigeon point, the southeast corner of the township lying on the shore of lake Winnipeg. From there a heavy growth of spruce, tamarack and jack pine extends along the 10th base line for six miles east, but beyond that the timber has been burned off and muskegs are more extensive.

Pigeon river crosses the base line near the east side of range 5. It is one of the largest streams of the district, having a discharge of about 1,500 cubic feet per second. It has its source, in common with Berens river, in a series of lakes near the Ontario boundary. It is navigable for canoes throughout its length, but there are many portages around its numerous rapids and falls. There are several good water-power sites near its mouth, the best being that known as Sturgeon falls where there is an abrupt drop of about eighteen feet.

The 9th base line was extended west to connect the levels with lake Winnipeg. The water level in the lake, during the past years, as marked on the rocks, along the shores, shows the lake to be lowering, and it was reported that hay was being cut at the mouth of Bloodvein river in sloughs which had always been too wet before. The base line was also extended east through range 7.

The east boundary of range 7 was next run from the 9th to the 8th base line (north of township 28). Bloodvein river crosses this line near the correction line, and flows northwesterly entering lake Winnipeg near the 9th base line. It rises in lakes and muskegs to the east, discharges about 1,000 cubic feet per second, and like the other rivers of this district its fall comes in abrupt drops over rock ridges where water-power could be developed. About four miles north of its crossing of the line it is joined by Leyond river, coming from the northeast. There is a water route by way of the latter stream through to Pigeon river.

Loon creek which flows along the north boundary of township 29 has some good timber along its course near the lake, and in the vicinity of its mouth there is some good hay land. Some half-breed settlers in that vicinity keep a considerable number of cattle.

The 8th base line was extended westerly to the lake and connected by means of a system of triangles across the lake with the portion of the base line which has been run easterly from the Principal meridian. As both shores of the lake were low, and the distance across about thirteen miles, a direct triangulation was impossible, and it was necessary to use Berry island, which is about half way across and one and a half miles south of the line. The levels were also connected by means of the lake with those of the base line on the west side.

We extended the 8th base line east through ranges 8 and 9, and then turned south again along the east boundary of range 9, where a closing was made with the earlier surveys to the south in township 26. This line passed about one mile east of Rice lakes. These are several small lakes joined by narrows in which wild rice grows very

luxuriantly, sometimes being six or eight feet high. Near the lakes there has been a good growth of spruce, most of which has been cut some years ago. Rice river flows from these lakes into lake Winnipeg.

In the district east of lake Winnipeg the granite bedrock is not far from the surface, outcropping frequently in scarred domes, on which glacial action is recorded by striations and smooth grooves. The weathering of these rocks has produced but scanty soil, indicating their recent emergence from the waters of original "Lake Agassiz". The areas between the islands are usually of a level lake bottom nature. The rocky prominences drain rapidly into the surrounding silt-filled basins where the underlying rock prevents absorption, and from its level nature surface flow is slow and also much retarded by natural rock dams, consequently the land around the rock outcrops is usually swampy but the soil is good.

The rivers are uniform and have little current except where they are broken by rapids in crossing ridges of rock. Good water-power sites are numerous, and some good agricultural land lies near the streams.

The timber is mostly small as the surface has often been fire-swept during dry years, but some isolated patches of merchantable timber are yet found along the lakes and rivers. Timber suitable for pulpwood is plentiful, and the numerous water-power sites and cheap transportation on lake Winnipeg should make paper manufacturing a profitable industry.

The minerals of this district are perhaps its most valuable asset. Gold has been discovered in the vicinity of Wanipigow river and the formation of the country points to the possibility of its being rich in minerals. Prospecting is difficult however on account of the moss generally covering the rock and the extensive swamps. The mining industry would be greatly assisted by cheap power and transportation.

Agriculture except in the proximity of the lakes and rivers, can not be followed till drainage on an extensive scale is done, but the soil should prove fertile. Hay is scarce and the long winter and lack of shelter render this district unsuitable for ranching.

Fish are plentiful in lake Winnipeg and the rivers running into it, and the fishing industry furnishes employment to the people living along the lake.

Game is abundant back from the lake and easy access is furnished by the rivers.

The work was completed on September 1, and the party left for Selkirk where it was disbanded on the 3rd.

APPENDIX No. 10.

ABSTRACT OF THE REPORT OF W. J. BOULTON, D.L.S.

STADIA SURVEYS IN THE LETHBRIDGE DISTRICT.

From Lethbridge, where I organized my party, we left for tp. 8-21-4, where our first investigation was made. After completing the work in this vicinity we moved south to tp. 7-19-4 and tp. 7-20-4, both of which we investigated.

The surface in this district is rolling and the lakes which are fairly numerous are very shallow, being not more than three or four feet deep. Sterling lake, or as it is locally called "Eighteen-mile" lake, has a very indefinite and variable shore line. The water level is entirely dependent upon the amount of surplus irrigation water which finds its way into the lake on its southerly side. This district is sparsely settled and is used almost exclusively for grazing.

The next work was the survey of St. Mary river and other water areas in tp. 7-21-4.

This river is rather winding in its course and has a current averaging three miles an hour. Its bed is about 250 feet wide, and the valley through which it flows is about 200 feet deep and 1,300 feet wide. This township is fairly well settled in its southerly and westerly parts, and a considerable amount of wheat and rye is grown there. The yield during the past season was excellent. There are a number of small coal mines operating in the valley of St. Mary river, which supply an ample amount for local consumption.

We next moved to the vicinity of Lethbridge, and commenced the survey of Oldman river, where it first crosses the east boundary of tp. 8-22-4.

In tp. 8-20-4 and tp. 8-21-4 as well as tp. 9-20-4 and tp. 9-21-4 a considerable amount of irrigation has been done and good crops of alfalfa, wheat, and oats are grown each year. The farmers also raise quite a number of hogs and cattle.

On July 30 we moved camp to tp. 9-21-4 and continued the survey of Oldman river through tp. 9-22-4 and tps. 9 and 10-21-4. There are some excellent coal mines in operation along the valley of Oldman river in tp. 9-21-4, viz. at Stafford Village and Hardieville, and during the past season a full complement of men have been engaged. The mine at Hardieville finds a market in Saskatchewan for its entire production.

Oldman river, like St. Mary river, pursues a very winding course and many nice flats are available on the inner curves of the river, the opposite sides at these points being cut banks about seventy-five feet high. The valley through which it flows varies from one-quarter to one-half mile wide. The area occupied by the bed of the river is from 400 feet to 600 feet wide, this being smaller than it was at the time of the original survey. This is no doubt due to the immense amount of water that is now being taken from St. Mary river, which is a tributary of the Oldman, to supply the needs of irrigation. Consequently, there is considerable tree plant vegetation found along and on what used to be called "Sandbars".

After completing the survey of Oldman river across tp. 11-19-4, we surveyed Little Bow river across the same township. This stream is small, being about seventy-five feet wide, and receives its main supply of water from Highwood river, to which it has been artificially connected in tp. 18-29-4. That part of the township west of the Little Bow is under cultivation, and produced a good substantial yield during the past season.

The townships farther north are well settled and good crops were secured this year as the moisture was sufficient. More oats are grown than farther south, where the raising of wheat is the staple industry. Stony sections are numerous and although this land is unfit for agriculture it is used for grazing, as it produces fairly good grass. Water is scarce and what can be secured from wells from seventy to eighty feet deep is mostly alkaline.

Many irrigation works are in process of construction but the lack of railroads will prevent farmers from marketing their grain.

After completing the work in the Lethbridge district, I moved to tp. 24-1-5 to traverse Bow and Elbow rivers across the township, and I also surveyed the Canadian Pacific Railway Company's irrigation canal and Nose creek in the same township. Bow river varies from 400 to 500 feet wide and has a current of three miles per hour. It is used by lumbermen for driving logs to the mills in Calgary.

On October 26, I closed operations and discharged the party.

APPENDIX No. 11.

ABSTRACT OF THE REPORT OF E. P. BOWMAN, D.L.S.

STADIA SURVEYS IN THE BATTLEFORD DISTRICT.

The stadia surveys on which I was engaged during the past season were in a block of about twenty townships north of Battleford.

The party was organized at Battleford and we left there on May 28 for our first work in tp. 43-13-3.

In addition to the stadia traverses of lakes, a number of section lines were retraced and monuments established at places where bodies of water had dried up since the original survey. This work, however, was only done in those townships where the amount of such work was not so great as to delay the stadia work unduly.

In the northerly part of this district, the outlines of the lakes previously surveyed have not changed much, though generally speaking, they appear to be getting somewhat shallower, which is shown by the receding of the shore line in the shallower parts. In the southerly part of my work, the change in the lakes is more marked, some being very shallow and these will probably dry up entirely in a few years, while others remain practically unchanged. A number of new lakes were also found in the district investigated this season, especially in the more northerly townships. The season of 1915 has been exceptionally dry in this district, so that the lakes are lower than they have been for some years.

The greater part of this area is settled fairly well excepting railway lands, several of the northerly townships being practically the north limit of the country where the homestead lands are mostly taken up. The surface is mostly rolling with bluffs of poplar and willow, becoming thickly covered with poplar, willow, second-growth poplar and windfall in places towards the northerly townships. Spruce, tamarack and jack-pine are also found in some of these north townships.

Most of the lakes are shallow and are only the result of surface drainage. They are drying up every year as the land is cultivated, and it is only a question of time till the most of them will entirely disappear. In many of these lakes the water is alkaline.

Hay lands are not plentiful but scattered patches are found, and grass grows in many places. The district was formerly a ranching area but it is now taken up as homesteads, although almost fifty per cent of the land is owned by companies and speculators on which there are no settlers.

Transportation facilities are poor as there are no railways and but few graded roads. For this reason many settlers have left the district even after securing their patents.

Timber for building purposes is plentiful and the settlers have taken advantage of this by erecting good houses and outbuildings.

Mixed farming is the principal industry and only enough grain is grown to feed the stock raised as shipping facilities are poor.

Muskrats are the only fur-bearing animals at all plentiful in this district, and some of the settlers engage in trapping these in the winter months. Many Indians engage in trapping around the lakes in this district, especially in the northern part. Coyotes are fairly numerous though not as numerous as on the prairie. Moose and deer are occasionally seen in the northern townships as far south as township 51. Ducks and geese are plentiful and prairie-chickens are fairly numerous in the better settled and more open districts, while partridges are occasionally seen in the wooded parts.

Fish are found in a number of the lakes in this district, particularly in Birch lake, Turtle lake and Jackfish lake. Winter fishing is carried on quite extensively on Turtle lake, jackfish and whitefish being the principal kinds caught.

APPENDIX No. 12.

ABSTRACT OF THE REPORT OF L. BRENOT, D.L.S.

SUBDIVISION SURVEYS IN THE PEACE RIVER BLOCK, BRITISH COLUMBIA.

My work for the season consisted of the subdivision of lands already settled, or suitable for settlement, in the vicinity of Peace river in the Peace River block. As most of the bench and bottom lands along the river had been previously surveyed my work was confined chiefly to the many plateaus on the north side of the river.

My party left Edmonton on May 7, 1915, and travelled by rail to Reno, which was at the time the end of steel on the Peace River Crossing branch of the Edmonton Dunvegan and British Columbia railway. From there the outfit and supplies were freighted to Peace River Crossing, where we waited until May 17, when the Hudson's Bay Company's steamer made its first trip up the river. We arrived at Hudson Hope on the 21st.

Our first work was in tp. 82-25-6, where we completed that part of the township not already subdivided. We then subdivided the southerly two-thirds of tp. 83-24-6, that part of tp. 83-23-6, north of Peace river, and the southerly one-third of tp. 84-22-6. We were very much hindered in tp. 83-23--6, by the precipitous banks of Halfway river which are from 700 to 900 feet in height. This stream was also very much swollen by heavy rains at the time of our survey.

On completion of these townships we constructed a raft on which we floated down the river to Taylor's landing in tp. 82-18-6, where we were met by the pack-train which had been sent overland. From this camp as our headquarters we subdivided the northerly one-third of tp. 82-17-6, all of tp. 83-17-6, and the northerly two-thirds of tp. 84-17-6.

Our survey operations were brought to a close on October 4, and on the following day we started for Peace River Crossing on our raft. We arrived back in Edmonton on the 14th.

The homesteading and farming prospects throughout the various parts surveyed are, for the most part, very encouraging. The surface is mostly rolling or undulating and in some places heavily timbered, but more often with alternate patches of prairie and poplar bluffs. The soil is fertile, and the growth of different kinds of grasses is very luxuriant. Hay sloughs are numerous, and many of them contain a permanent supply of good water. The whole district surveyed seems well suited for stock raising, and as there are many extensive tracts of nearly open country, farming could be carried on successfully without much additional clearing.

It is now comparatively easy to reach this district by the Edmonton Dunvegan and British Columbia railway, which was expected to be completed to Peace River Crossing by November 15, 1915. By the old winter trail the journey from Edmonton to this point usually took two weeks; it can now be accomplished in one day by train. In the summer, from the middle of May to the beginning of September, two steamers, of a capacity of fifty to sixty tons each, ply the river between Hudson Hope and Fort Vermilion, a distance of over 500 miles. Several large gasolene boats also made numerous trips last summer, carrying both passengers and freight. Two other boats of a grater capacity than any on the river at the present time, are under construction at Peace River Crossing, and will be launched in the spring, so it can reasonably be expected that the freight rates for next season will be reduced considerably. The winter route is also much improved. It is expected that the railway will be completed to both Spirit River and Grande Prairie early in 1916, and as there are roads

leading from both of these places to Pouce Coupé, the prospective settler can choose his own route. From the latter place the pack-trail leading to Fort St. John has been improved sufficiently to allow the passage of wagons, as was also the pack-trail on the north side of Peace river from Fort St. John to a point within eight miles of Hudson Hope. At the latter point there are clay landslides extending to the water's edge, and to continue any farther, a road would have to be gouged out of these side-hills for a distance of nearly a mile, and when completed would not be permanent, as these clay slides are continually moving.

The condition of the services into this country has improved considerably during the past year. Fort St. John receives mail from Lake Saskatoon, Alberta, twice a month and this service was to be extended to Hudson Hope before winter set in. But as the delivery depends largely upon the state of the various rivers on the mail route, on none of which ferries are operated, the arrival during certain seasons, is still very irregular. The government telegraph line from Lake Saskatoon was extended to Hudson Hope last August.

Taking into consideration the general conditions found, and the probable developments of the next few years, this district has a promising future for both agriculture and industry.

APPENDIX No. 13.

ABSTRACT OF THE REPORT OF M. P. BRIDGLAND, D.L.S.

PHOTO-TOPOGRAPHICAL SURVEYS IN JASPER.

The party left Calgary on June 21, 1915, and arrived at Jasper on the following morning, but owing to cloudy and wet weather actual work on the survey near Jasper was not commenced until the 27th. From there it was carried south and west, covering the Athabaska valley to the mouth of Whirlpool river, and Miette valley to near Yellowhead pass. In order to include some tributaries entering the Athabaska and the Miette within the above limits, the work was extended south to cover townships 43, ranges 1, 2 and 3, west of the Sixth meridian. This portion of the work was completed on July 28.

Work was then continued down the east side of the Athabaska valley, covering the lower parts of the valleys of Maligne and Rocky rivers and Fiddle creek. The trails in these valleys are in good condition but the trail along the Athabaska is used very little and in high water is almost impassable. Good progress was made with the survey up to August 17, but during the remainder of the month, owing to rain or smoke, very little could be accomplished.

On August 31, the party crossed Athabaska river at Pocahontas, intending to work back along the west side of Jasper. The main streams entering from this side are Moose creek, Stony river, and Snaring river. There are trails up the two first-mentioned streams but none up the third. The main trail along this side of the Athabaska is in good condition except at one place where it is flooded by a beaver pond. Owing to continued unfavourable weather, this work required a longer time than had been expected and was not completed until September 27. A small party was then sent to the head of Jack creek near Interlaken, with instructions to extend the work there and in the valley of Rocky river, a little farther east, while the remainder of the party undertook to occupy two stations on the Maligne range overlooking the Athabaska valley to the south of Jasper. Owing to bad weather, these trips were only partially successful and both parties returned to Jasper early in October.

A traverse was made of the Grand Trunk Pacific railway from near Parkgate to Yellowhead pass to serve as a base for our triangulation system. During the summer when other work was impossible, this traverse had been carried from the eastern or northern limit to near Jasper. It was now continued to near Yellowhead pass and was completed on October 13. The party then returned to Jasper and made arrangements for storing the outfit and wintering the horses. On the 15th they left Jasper for Calgary where the men were paid off on October 18.

The season of 1915 was very unfavourable for photographic work. From June 24 to October 15, there were only forty-eight fine days out of a total of one hundred and fourteen, and even on the fine days there was nearly always a slight haze or heavy cloud shadows. In July, September, and October, much delay was caused by wet weather while in August twelve days were lost owing to smoke. These unfavourable conditions, combined with the unusual width of the valleys, made it very difficult to obtain satisfactory views.

The total length of the season was one hundred and twenty days. During this time, eighty-nine triangulation stations were occupied and a traverse of more than fifty miles of the railroad was made. About thirty of the more prominent peaks were located by triangulation, though not occupied.

From a scenic standpoint, Jasper park has many attractions. The valley of Athabaska river is much wider than that of most mountain rivers. The valleys of Stony and Rocky rivers are also very wide with rolling benches extending back to the main ranges. The mountains seen from the railroad are comparatively low, most of them being from 7,500 to 8,500 feet above sea-level, or 4,000 to 5,000 feet above the valley. A few peaks reach an elevation of 9,000 feet or over. Near Jasper there are large flats and benches dotted by many beautiful lakes. Alpine districts of a more rugged nature may be reached easily from Jasper in two days. The Maligne lake district and that south of Jasper adjacent to the interprovincial boundary are especially worthy of mention.

The Miette hot springs are situated on the west branch of Fiddle creek about twelve miles from Pocahontas, from which place they are reached by means of a good pack-trail. The temperature of the different springs varies from 100 to 130 degrees Fahrenheit and the waters are said to have wonderful medicinal qualities.

Nearly all of the district included in our survey has been burned over and is now covered with a good growth of small jack pine, poplar, and spruce. Very little standing timber of commercial value was seen and the greater part of what does exist is in places difficult of access. In the mountains to the south and west of Jasper and on the south branches of Miette river, there is green timber but the valleys are narrow and rise quickly to a high elevation. The valley of Snaring river, as yet untouched by fire, is heavily timbered, but is very narrow. Good timber was seen also on the south branch of Stony river and on the upper part of Drystone creek. The timber is chiefly spruce twelve to eighteen inches in diameter.

So far as could be learned, no minerals of importance, other than coal, have been discovered. At Pocahontas there are coal mines on both sides of Athabaska river.

Game is protected throughout the park and is quite common. Sheep, goats, deer, caribou, and beavers were frequently seen. Only one bear was actually seen, although tracks were often noticed. In the main valleys there are many rabbits and coyotes, the latter being particularly in evidence. There are some game birds but they are not very plentiful, and in the fall a few ducks and geese visit the Athabaska valley and the neighbouring lakes. Fish does not appear to be plentiful in the streams, but it is reported that there is good fishing in some of the lakes near Jasper.

APPENDIX No. 14.

ABSTRACT OF THE REPORT OF J. H. BROWNLEE, D.L.S.

SURVEYS IN THE YUKON TERRITORY.

In company with H. G. Dickson, D.L.S., of Whitehorse, I made an examination of the Wheaton district and later of the Kluane district beyond Champagne Landing. Later I made an examination of the pasture land enclosed by the White Pass and Yukon route, on the west side of lake Laberge. I concluded that the best pasture lands were situated between Champagne Landing and Takhini, and it was decided to make these available by making stadia traverses of the meadows only, which is not expensive survey work.

I proceeded to Dawson and recommended a contract to Mr. Dickson including the unsurveyed portion of the Kluane road. This survey is complete, but the returns have not yet been received.

On July 13, I proceeded from Dawson to Mayo, surveyed Mayo Indian Reserve for the Department of Indian Affairs, made two small correction surveys at Minto for the Department of the Interior, and made an examination of Mr. Dickson's 1914 contract on Sixtymile river. The remainder of August and September were spent in preparing the returns of surveys made at Minto and Mayo.

APPENDIX No. 15.

ABSTRACT OF THE REPORT OF J. A. BUCHANAN, D.L.S.

SUBDIVISION SURVEYS NORTH OF PEACE RIVER CROSSING.

The organization of my party was commenced at Edmonton on April 15, 1915. It was my intention to leave there for the scene of my season's work on April 25, but on account of freight car shortage we were delayed until May 5. We arrived at Peace River Crossing on the following day, having travelled the last thirty miles by trail.

On Monday, May 10, the outfit was loaded on a scow and we started down the river; on the following day we reached our first camp, in tp. 90-21-5.

Our work for the season consisted of the subdivision of townships 90, 91, and 92, range 21, and townships 91 and 92, range 20, all west of the Fifth meridian. As these townships are nearly all traversed by Peace river we used the river as our principal means of transportation. Our provisions were cached at convenient points along the river and most of our camps were located on the river bank.

Practically the whole of these five townships are thickly wooded with second-growth poplar and willow brush, and in many places the windfall is very thick. On account of the valleys of Peace river and the many small streams that flow into it, a great deal of the country is necessarily very rough, but there are several fine river-flats in these valleys. The table-land back from the river valleys will, for the most part, make good agricultural land. There are a few swamps, but in all cases these could be quite easily drained. The climate is fine and warm, and there are no frosts until well on in the fall.

I took the larger portion of the party out to Peace River Crossing during the first week in October, retaining only four men to assist in traverse work. This was completed in time to enable us to track up the river before it was finally frozen over. We arrived in Edmonton on October 31.

APPENDIX No. 16.

ABSTRACT OF THE REPORT OF J. A. CALDER, D.L.S.

MISCELLANEOUS SURVEYS IN THE KAMLOOPS DISTRICT.

On April 14, 1915, I left Ashcroft with my party and proceeded to tp. 16-24-6, where our first work of the season was located. The subdivision of that part of the township outside of Nicola Forest reserve was completed, part of the reserve boundary was surveyed, and portions of Nicola river were traversed.

Subdivision was then carried into the northwest quarter of tp. 15-24-6, to include some valuable grazing and agricultural land. Nicomen Indian reserves Nos. 9 and 12, and Lower Nicola I.R. No. 11, were retraced and tied in. Some improvements claimed by Indians were found to be outside the reserves and on Dominion Lands.

On June 8, camp was moved to Potato Illahie, a small Indian village on Nicola river near the mouth of Skuhun creek in the same township. From this camp the boundaries of Nicola Forest reserve were established through the northeast quarter of the township and through tp. 15-23-6, where not already run, and the retracement of Lower Nicola I.R. No. 11 was completed, including the traverse of a portion of Nicola river. The land embraced by these surveys is mostly mountainous and broken. There are some extensive benches along the river in the Indian reserve, and some of these are well cultivated. Nicola river, where it passes through these townships, is very turbulent and averages from two to three chains in width. I am informed that it furnishes excellent fishing.

Surveys along the Nicola were completed on July 7, and on the following day we moved by train to Ashcroft, and thence by wagon to upper Hat creek, in tp. 19-26-6, where we arrived on the 10th. The road from Ashcroft to this district has been shortened recently. It now follows Oregon Jack creek and up over the divide to Hat creek, joining the old wagon road, via the mouth of Hat creek, in section 29.

The west half of this township was subdivided, where not already done, and the boundaries of Hat Creek Forest reserve were established. This district is well adapted for stock raising and dairying.

Our next work was in tp. 22-25-6, where portions of the boundaries of Hat Creek and Arrow Stone Forest reserves were surveyed and some agricultural and grazing lands subdivided. This district is essentially a stock country, and large quantities of hay and grain are grown along Bonaparte river for winter feed, while the surrounding hills furnish pasturage during the summer.

Our work in this vicinity was completed on September 15, and the main party moved to Barnes lake in tp. 20-24-6, while with one man, I proceeded to tp. 18-28-6, where an old provincial lot was reported to be on Dominion lands. This lot was retraced and tied to the Dominion Lands system, and I rejoined the party on the 21st.

In township 20, range 24, some subdivision was made, a portion of the western boundary of Nicola Forest reserve was run, and a lake which was discovered last season on previously surveyed lands, was traversed. The portion of the township embraced by our work is hilly and open or sparsely timbered with fir and bull pine. Mixed farming is carried on in a small way, but the country is best adapted for stock raising. In connection with the resources of this district I might mention that we made the acquaintance of a man who was engaged in locating colonies of wild bees. While we were working in that vicinity he found six or eight "bee trees," yielding profitable quantities of honey.

Our work in this township was completed on September 22, and our next move was to tp. 22-21-6. The party and supplies were ferried by gasolene launch from Savona across Kamloops lake, to the mouth of Copper creek. From this point there is a fair wagon road up Copper creek to Seven Lakes post office, about the middle of the township. The southerly boundary of Tranquille Forest reserve was completed through this township and some resurvey work was done. A number of quarter-sections along Copper creek and on the divide towards Sparks lake have been settled on in recent years, and small patches brought under cultivation.

My party was discharged at Ashcroft on October 6, after which I was engaged for a few days on a small survey in tps. 20 and 21-26-6. I arrived home on October 14.

APPENDIX No. 17.

ABSTRACT OF THE REPORT OF WM. CHRISTIE, D.L.S.

SUBDIVISION SURVEYS AND BASE LINE RETRACEMENT NORTH OF PRINCE ALBERT.

My summer work consisted of the subdivision of a part of township 52, range 21, part of township 53, range 20, all of townships 53, ranges 21, 22 and 24, and the south two-thirds of townships 54, ranges 22, 23 and 24, all west of the Second meridian.

I left Prince Albert with my party on May 14 and arrived in tp. 53-24-2 on the 17th. Work was commenced the following day, and from that date was continued with but a little interruption until October 9, when our subdivision surveys were completed.

Three main wagon roads from Prince Albert cross the portion of country covered by this survey. The most westerly of these passes through settled country by way of Henribourg, in tp. 51-25-2, and thence to Paddockwood in the next township north. From Paddockwood a road, locally known as the Mosher trail, runs northerly across tp. 53-25-2, and thence northeasterly to Torch lake. The road is graded and in good condition from Prince Albert to the north boundary of tp. 51-25-2. From there north it is fairly good during dry weather, but rather bad during wet weather.

The second road runs northeasterly from Prince Albert to Candle lake. There are places in this trail over which it would be impossible to haul loaded wagons in its present condition. I opened a wagon trail from sec. 30 to sec. 9, in tp. 54-23-2, connecting the Candle lake trail with the Mosher trail.

The most easterly of the three roads referred to is graded through settled country to Meath Park in tp. 51-23-2. From there it follows the Hudson Bay and Pacific railway line which runs in a northeasterly direction across tp. 52-21-2 and tp. 53-20-2. During dry weather this trail is fairly good as far as the centre of tp. 52-21-2, but during wet weather, it would probably be bad in spots. Farther north it is very bad in some places.

The land between Prince Albert and Paddockwood is mostly taken up. Many farms in the Henribourg district present quite a prosperous appearance, but farther north, in the Paddockwood district, settlement has been more recent. Wheat, barley, oats, potatoes, and garden vegetables are grown successfully on a small scale. The country between Henribourg and Meath Park is all settled and presents a prosperous appearance.

No squatters were found on any of the land surveyed during the season, but a number of settlers have located in tp. 53-24-2 since the completion of the survey.

Most of the land in these townships is gently rolling and covered with poplar, spruce, jack pine and tamarack, but most of the timber which is of merchantable quality is included in the various timber berths in the district. Some areas of timber have been fire-killed during recent years. The soil is clay, clay loam, or sandy loam, with varying depths of muck and leaf mould on the surface.

There are a number of small lakes in the district, but the only one of importance is Birchbark lake in townships 52 and 53, ranges 21 and 22. It is about six miles long and averages about two miles in width. Its most important outlet is Birchbark creek which flows northerly into Torch lake. No streams flow into it.

Very little hay is to be obtained in any of the townships surveyed. In most places where the country has been burned over, however, good grazing is found.

All the muskegs are shallow and there is ample slope to render draining comparatively easy. If these muskegs were drained and the moss burned off, I have no doubt

that they would furnish excellent hay lands, even if they are not suitable for other crops.

The climate throughout the district resembles that at Prince Albert. Summer frosts occur, but are not often severe enough to seriously damage crops.

All the water in the district is fresh, and the supply is sufficient and permanent.

Big game is plentiful throughout the district. It consists of moose, elk, caribou, and bears. Coyotes are also very numerous. Foxes, beavers, muskrats, partridges, prairie-chickens, and ducks were also noted. Jackfish are found in Birchbark lake, but do not appear to be very plentiful.

No coal, lignite, stone-quarries, nor minerals of economic value were noted.

Early in March of 1916 I organized another small party for the retracement of the 15th base line through ranges 22 to 27, inclusive, west of the Second meridian.

We left Prince Albert on March 13, and travelled by sleigh to our destination. The road from Prince Albert to the south end of Torch lake was in good condition. From this point to the base line we travelled over Torch and Candle lakes, breaking our own trail as we went. On arriving at the intersection of the base line with the east shore of Candle lake I sent two teams back to Henribourg to bring up sufficient hay and oats to last throughout the work.

Work on the line was commenced at the NE. cor. tp. 56-22-5, on March 20. The snow was very deep in the vicinity of the line, making progress difficult and slow. The retracement was completed to the Third meridian on April 6, and on the following day we started via the Montreal Lake trail for Prince Albert where we arrived on the 11th.

The country crossed by this line is very similar to the townships to the south which I subdivided during the previous summer, except that in the eastern portion there is more muskeg.

The line crosses Candle lake in range 23, about a mile from the north end of the lake. This lake is about fifteen miles long from northwest to southeast and from two to five miles wide. Whitefish and jackfish were caught quite extensively in this lake a few years ago, but the industry has been practically abandoned.

Bittern lake is crossed by the line in range 26. It is about seven miles long from north to south and from one to two miles wide. The greater part lies north of the base line. Whitefish are said to be plentiful in this lake.

From Bittern lake to the Third meridian the land is rolling and timbered with poplar, birch, spruce, and jack pine up to about six inches in diameter, with local areas of spruce and tamarack muskeg.

The snowfall during the past winter in the vicinity of the 15th base line was heavier than usual, and the spring somewhat later, but the climate generally does not differ materially from that at Prince Albert.

Moose, elk, cariboo, and coyotes are plentiful in the vicinity of the line, and foxes and timber wolves were also seen.

APPENDIX No. 18.

ABSTRACT OF THE REPORT OF G. W. COLTHAM, D.L.S.

STADIA SURVEYS IN THE WAINWRIGHT DISTRICT.

Survey operations were commenced in tp. 45-8-4 on June 2, and traverses of lakes and investigations of other water areas were completed in the following townships throughout the season:—

Township 44, range 9, township 45, range 8, townships 44 and 45, range 7, townships 43, 44 and 45, range 6, townships 43, 44 and 45, range 5 and township 44, range 3, all west of the Fourth meredian.

In several of these townships the necessary monuments were established where bodies of water had dried up since the original survey of the township, but where this work could not be carried on conveniently and expeditiously, it was left undone.

The water in most of the lakes traversed during the season was alkaline but not to such an extent as to render it unfit for stock, and after boiling or filtering through the soil, was quite fit for drinking. Baxter lake in townships 45 and 46, ranges 5 and 6, contains turbid water which is practically soft and is of a most unpleasant taste.

The farmers throughout the entire district visited appear to be singularly prosperous. This district has many natural advantages,—the soil permits of easy cultivation, the surface is gently rolling or undulating with consequent adequate drainage, good water for domestic purposes is nearly everywhere obtainable at moderate depths, while the rainfall is sufficient to ensure proper growth of all field crops. I was informed that destructive early frosts were unusual.

No minerals or mineral-bearing rocks of economic importance were seen.

Game is not particularly plentiful. Ducks were seen on nearly all the lakes, and on Baxter lake several geese were noticed. Prairie-chickens are fairly numerous.

The weather during the month of June and July was fine with occasional showers. The farmers regarded the season a very favourable one as to weather conditions.

APPENDIX No. 19.

ABSTRACT OF THE REPORT OF J. M. COTE, D.L.S.

MISCELLANEOUS SURVEYS IN SASKATCHEWAN.

My first work for the season was the completion of the resurvey of tp. 51-23-3 which I had left unfinished in 1914. This township is dotted with poplar bluffs, willow bush and numerous small lakes and sloughs. The water in most of the sloughs is fresh, which, coupled with the abundant hay growing around the lakes and sloughs, makes the district ideal for ranching. The settlers are mostly French Canadians who seem to be quite prosperous. This resurvey was completed on May 8 and on the 10th I left for tp. 47-22-3, crossing Saskatchewan river by the Paradise Hill ferry, which is in the west of range 24. The country along the trail followed is hilly, with patches of poplar and willow bush, and is thinly settled.

The surface of tp. 47-22-3 is gently undulating to rolling, dotted with poplar bluffs and willow bush, and the soil is mostly sandy loam. The main line of the Canadian Northern railway crosses the township.

On June 1 we left for tp. 40-14-3, following the old Edmonton-Battleford trail to Battleford and thence over local trails and road allowances. Although the country passed through has been opened for a number of years it is thinly settled. It is rolling and covered with poplar and willow bush, with some open patches.

We resurveyed those parts of tp. 40-14-3 lying outside of Keppel Forest reserve and on June 25 proceeded by trail to Bad lake in tps. 27 and 28-18-3, and from there to Kiyiu lake in tps. 30 and 31-21-3. The land along these trails is all occupied and the settlers, the majority of whom depend solely on grain growing, find it sometimes hard to make a living. Both Kiyiu and Bad lakes previously reported dry, were on account of the wet weather, full of water. It was therefore impossible to carry out the instructions received to extend the subdivision lines across the dried-up portions of the beds of these lakes.

On July 7 we left for tp. 27-27-3, which we resurveyed. The work there was somewhat delayed owing to the huge stone piles found at all the corners, and which had to removed. This country has only been opened up for five or six years, but is nevertheless well settled. While the main party carried on operations in this township, I drove to tp. 27-28-3, to correct certain markings on the witness post at the northeast corner of section 22.

On July 23 we started for the vicinity of Duck Lake, Saskatchewan. From Flaxcombe to Fiske, a distance of fifty-two miles, we followed a good graded road along the south chord of township 29 and then followed the roads between towns along the Canadian Northern railway. The district passed through is well settled and the crop outlook was good.

We arrived in tp. 43-2-3 on August 3, and began the resurvey of this township and the one immediately north of it. They are thickly settled, some homesteaders having lived there since the early eighties. The surface is nearly level and is mostly well covered with poplar from four to ten inches in diameter and willow bush. Many lakes and sloughs occur. All the surface water is more or less alkaline but farmers get an ample supply of good water from wells twenty to forty feet deep. The Saskatoon-Prince Albert branch of the Canadian Northern railway passes through these townships. Most of the old surveyed trails are being abandoned as the road allowances are gradually being opened up. Although wet weather prevailed generally throughout

the western provinces during 1915, it was very dry in this district and the crops in consequence were not very good.

The resurvey of certain lines in tp. 43-27-2 was the next work undertaken. While the main party was employed on this work a sub-party retraced a few lines in tp. 43-28-2. I also visited tp. 41-23-2. It has a rolling surface covered with patches of poplar and willow bush. The soil is good and I was informed that crop failures were unknown in this district. Middle lake lies in the northeast corner of the township; it is three or four miles across.

I closed operations on October 25, and proceeded to Humboldt where the party was discharged.

APPENDIX No. 20.

ABSTRACT OF THE REPORT OF G. C. COWPER, D.L.S.

STADIA SURVEYS IN SOUTHWESTERN SASKATCHEWAN.

My work for the season of 1915 was confined to a group of about eighty townships in the vicinity of Swift Current, and consisted of the traverse by stadia of all lakes of a permanent character over five acres in extent and of rivers averaging a chain or more in width, the investigation of all lakes and sloughs which had dried up since the original survey, or which were likely to dry up, and the erecting of monuments in the dried-up beds of lakes.

The work was commenced in tp. 6-21-3, where we traversed Frenchman river and surveyed two irrigation reservoirs. From there we worked easterly and then northerly through townships 8, 9 and 10, range 19, and township 10, range 18. No lakes were found in the latter township.

In sec. 31, tp. 6-21-3 is situated the thriving town of Eastend. An excellent clay for pottery is found near there and also an excellent quality of quartz sand suitable for making glass. A fair quality of lignite coal in small veins is to be found in the Cypress hills to the west. Surface indications of oil and gas were noticed, and well-drilling operations were in progress. If gas is found in commercial quantities, Eastend may become an important manufacturing town. In the valley of Frenchman river in this township is located the largest privately-owned irrigation system in southern Saskatchewan.

On completion of this work we moved to tp. 13-17-3, and throughout the remainder of the season we progressed as follows, investigating as we went: First northerly through townships 13 to 16, ranges 16, 17, and 18, thence easterly through townships 15 and 16, as far as range 8, then back westerly through townships 17, 18, and 19, as far as range 16, and finally through the townships along South Saskatchewan river between ranges 14 and 18, inclusive. Altogether we completed the investigation of sixty-seven townships and partly investigated seventeen others. The work was finished on October 22.

Antelope lake in tp. 15-18-3, was the largest lake traversed during the season. It is about four miles long, a mile and a half wide, and about thirty feet deep in the centre. It is fed by Thirty-two-mile creek and by springs, but as it has no outlet the water is alkaline.

Another permanent lake was found in townships 17 and 18, range 15. This lake is about two miles long, from ten to thirty chains wide, and thirty feet deep. It is fed by springs, and is strongly alkaline.

In townships 17, 18, and 19, ranges 8, 9, and 10, where there were a large number of lakes at the time of the original survey, I found very few water areas still in existence. Rush lake, in townships 17, ranges 10 and 11, which was formerly about five miles long and from two to three miles wide, is now dry, and the main line of the Canadian Pacific railway crosses the centre of the old bed. The railway company was largely responsible for draining it.

Most of the lakes throughout the district were found to have dried up, and many of the dry beds are producing good crops of hay. In the event of a series of wet seasons a number of them may fill up again but it is unlikely that they will ever hold water for any length of time. With two or three exceptions, all of the lakes traversed were from one to two feet in depth, with soft alkaline bottoms.

The traverse of Saskatchewan river through ranges 14 to 18, inclusive, was commenced on September 11. The course of the river was found to have changed considerably since the original survey. A large number of islands, not shown on the original township plans, were also surveyed. They were found to be most numerous in ranges 17 and 18. These islands as well as the banks of the river are mostly covered with dense willow and small poplar.

The valley of the river, except in tp. 20-16-3, where it is two miles wide and about 400 feet deep, has gently sloping sides, and the river has low banks. The valley is well settled. There are still a number of ranchers along the river, but practically every quarter-section which is not under lease for grazing purposes has been homesteaded.

The Provincial Government has three ferries in operation in the townships in which I worked, to enable the settlers north of the river to reach the railroad to the south. One of these ferries is located in tp. 20-17-3, one in tp. 20-16-3 and one at Saskatchewan Landing in tp. 19-15-3. The last is a very old crossing, as it is at the point where the trail from Swift Current to Battleford crosses the river. It was along this trail that the troops moved in going from Swift Current to Battleford during the Northwest Rebellion.

This district is in the dry belt, and the rainfall usually is light. In 1915, however, it was abundant, and the land on which the crops of 1914 were almost a total failure, yielded as high as sixty bushels of wheat, one hundred bushels of oats, or thirty bushels of flax, per acre.

Some of the settlers, especally those in the townships along South Saskatchewan river, have great difficulty in getting water. In some cases the river is the only source of supply. In other parts of the district the Provincial Government has constructed reservoirs by damming small coulees and excavating basins in front of the dams. Some of the reservoirs noticed were about 500 feet long, by 200 feet wide, and twenty feet deep.

The district is well settled and well served by railroads. The main line of the Canadian Pacific railway runs westerly through the centre; the Weyburn-Lethbridge branch parallels it to the south, while the northerly portion is served by the Swift Current-Bassano branch.

In many of the townships examined practically every quarter-section was under crop, and the majority of the road allowances are graded. A large number of the settlers have telephones, and are on rural free mail-delivery routes, and every year these services are being extended. It will not be many years until southern Saskatchewan, which ten years ago had very few settlers except the ranchers, will have all the conveniences enjoyed in the rural districts of Ontario.

APPENDIX No. 21.

ABSTRACT OF THE REPORT OF A. L. CUMMING, D.L.S.

SUBDIVISION SURVEYS WEST OF ROCKY MOUNTAIN HOUSE.

My work for the season of 1915 consisted of original subdivision in townships 41, range 9 and 10, the northerly one-third of township 39, range 10, and those parts of townships 39 and 40, range 11, lying north of Saskatchewan river, all west of the Fifth meridian.

To reach this district, we travelled by train from Edmonton to Rocky Mountain House, and thence by wagon to tp. 41-10-5. The work lasted from May until November.

Townships 41, ranges 9 and 10 are best suited for ranching purposes. They are rolling and well wooded, and have a luxuriant growth of grass and peavine.

The other lands covered by my survey are mostly wooded with second-growth spruce, jack pine, and poplar, most of the valuable timber having been cut off for the timber work in connection with the Canadian Northern railway, which passes through these townships. The soil throughout is good but the surface, on the whole, is too hilly to be suitable for farming. A number of oil claims have been located in these townships but very little development work has been done.

Large game abounds in this district, moose, deer, and beavers being very plentiful. Coyotes are also numerous, but not many foxes, mink or martens were seen.

APPENDIX No. 22.

ABSTRACT OF THE REPORT OF T. A. DAVIES, D.L.S.

SUBDIVISION SURVEYS NORTHWEST OF DUNVEGAN.

My work for the season of 1915 consisted of the subdivision of townships 80, 81, 83, 84, and the westerly half of township 82, range 5, and the easterly one-third of township 80, range 6, all west of the Sixth meridian.

The party, which was organized at Edmonton, left on May 11, via the Edmonton Dunvegan and British Columbia railway. From the end of steel to Peace River Crossing the road was found to be very bad, making freight rates excessive, and the part from Peace River Crossing to Dunvegan, which is usually in good condition, was soft and muddy. Two days were spent in cutting a trail into tp. 81-5-6, the scene of our first work, where we arrived on May 22.

During the first six weeks our work was considerably hindered by the excessive rains, but during the latter part of the season the weather was fine.

The district covered by my surveys seems best suited for mixed farming. The soil is a black loam with a clay subsoil. The surface generally is undulating and timbered with poplar and spruce. There are some creeks but they are neither large nor numerous. No lakes, ponds, or sloughs of appreciable size were seen. At present grain growing is carried on successfully in the district immediately to the east of these townships.

Township 81, range 5, and the part of township 80, range 5, north of Peace river are cut off from the east by a creek which flows southerly along the east boundary of these townships. At present there is no road across it except an indefinite pack-trail, and it would be very expensive to build a wagon road on account of the depth and roughness of the valley.

Our work was brought to a close on October 15.

APPENDIX No. 23.

ABSTRACT OF THE REPORT OF H. S. DAY, D.L.S.

SUBDIVISION SURVEYS NORTHWEST OF DUNVEGAN.

After organizing my party and completing my outfit, I left Edmonton on May 4, and proceeded by rail to Reno, and thence by wagon via Peace River Crossing to Vanrena, a post office about twelve miles north of Dunvegan. For the first part of the journey, from Reno to Peace River Crossing, the road was bad, but from there to Vanrena, it was in excellent condition and good progress was made.

At Vanrena we stored part of the provisions for use during the latter part of the season, and proceed with the remainder to Island lake where they were cached with a rancher. From there we continued along the Fort St. John pack trail to the 22nd base line which we then followed as far as tp. 84-6-6, where our work commenced.

During the season we surveyed tps. 81, 82, 83, and 84-6-6.

These townships are traversed from north to south by the valley of Peace river, which in this district, is from 800 to 900 feet deep, with very steep sides, the river itself being a little over a quarter of a mile in width. During the flood season in July and August it was at least fifteen feet deeper than during normal periods.

There is little merchantable timber in the district except on the west side of the river in township 81, where there is some good spruce. It would be difficult to get this out, however, on account of the many deep ravines in the township.

While there are considerable areas in these townships which are suitable for agriculture, they are somewhat isolated on account of the valley of the creek in range 5, which cuts off communication with the settlement to the north of Dunvegan. The district would therefore seem best suited for grazing purposes. There are, however, no large hay meadows and a rancher would find it necessary to grow fodder of some kind.

Most of the quarter-sections along the road from Peace River Crossing to Dunvegan have been taken up, and the settlers who have land under cultivation report excellent crops. The main crop consists of wheat and oats. I saw a forty-acre field of oats which averaged over one hundred bushels per acre, and wheat averaged from thirty to fifty-five bushels per acre. All ordinary vegetables seem to do well in this district. Well-ripened tomatoes were seen and several gardens were noticed where sweet peas and pansies were growing in profusion. So far the settlers in this district have had no crop failures on account of summer frosts.

Only a limited number of horses and cattle have so far been taken to this district, owing to the difficulties of transportation. This will no doubt be quickly remedied now that the railway is so easy of access. Horses from outside districts do not seem to do well, and large numbers have died from what is known as swamp fever. It is probable, however, that some way of combatting this disease will soon be found.

The main portion of my party and outfit returned to Edmonton on October 4. The remaining members, who were left to traverse Peace river through the townships surveyed, reached Edmonton on the 16th.

APPENDIX No. 24.

ABSTRACT OF THE REPORT OF W. J. DEANS, D.L.S.

MISCELLANEOUS SURVEYS AND INSPECTION IN MANITOBA AND SASKATCHEWAN.

On July 28, 1915, I left Prince Albert for my first work, the inspection of the surveys done by Mr. W. Christie, D.L.S., south of Candle lake.

The country north of Prince Albert for a distance of about eight miles is largely sand hills, but there are some small areas of good land which are settled on. About four miles south of Henribourg the country changes from sand to a deep black loam well adapted for farming purposes, and it is well settled up to a point three miles north of Paddockwood; from there to Candle lake the country is largely jack pine ridges with marshes and muskegs, and not of much value for farming purposes.

Township 53-24-2 contains some good land, but at the time of my visit was without any settlers. The township is rolling and covered with a thick growth of quite large poplar and spruce, but in many places there are good open spots which would require very little work to clear. The soil is a good black loam with clay and sand subsoil.

On our return trip to Prince Albert we visited tp. 51-26-2 and traversed a lake which had been overlooked in the original survey of the township.

On August 9, we left Prince Albert and proceeded to Winnipegosis, where a boat was hired to take the outfit to tp. 37-17-Pr., a distance of about fifty miles. The work there was to inspect the survey of Mr. O. Rolfson, D.L.S. While in that vicinity I also visited tp. 34-17-Pr. in order to place a post which had been omitted in the original subdivision. Townships 37 and 38, range 17, of Mr. Rolfson's survey, lie along the east side of lake Winnipegosis,are low and level, and are covered with a thick growth of poplar, willow, and spruce. In many places there are extensive tamarack swamps, but there are a few good locations along the shores of the lake which are suitable for settlement.

Our next move was to tp. 14-15-E. to inspect the work of Mr. W. A. Scott, D.L.S., who was engaged in subdividing townships in eastern Manitoba south of Winnipeg river. In order to reach this township we travelled by train to Lac du Bonnet, thence by the City of Winnipeg's tramway to Point du Bois, from there by canoe down Winnipeg river some three miles, and then over a portage of a mile and a quarter to lake George.

The land in townships 14 and 15, range 15, is largely rock ridges and swamps. There are, however, numerous small areas of fine rich land which would yield an abundance of potatoes and vegetables. There are also many patches of land which would be fit for agricultural purposes by drainage.

A few settlers around lake George are engaged in fishing and trapping. This lake is quite a resort for tourists in summer and is patronized by Winnipeg people attracted by the many beautiful camping places around the lake and the abundance of fish in its waters. It is somewhat difficult to reach, which adds additional charm and lures the more adventurous.

On July 28, we started for tp. 24-6-E., on Hecla island in lake Winnipeg, passing through Lac du Bonnet, Winnipeg, and Selkirk. We were detained at Selkirk two days waiting for the steamer which sails weekly for all points on the lake. On September 2, work was started on the resurvey of this township. The monuments were either destroyed or had fallen down so that the settlers were in doubt as to their boundaries and had petitioned to have a resurvey. I spent about six weeks in this

township retracing all the lines and re-marking the corners, in many cases with the new style of iron posts. The township fronts the lake on the east side, and is well settled along the shore with Icelanders and their descendants, who are largely engaged in fishing and cattle raising. There is little or no attempt made at farming. The settlers do not even appear to raise sufficient potatoes and vegetables to supply the local demand. The interior of the township is largely tamarack swamp and hay meadows and could be easily drained and made useful as the soil beneath the moss of the swamps is good. The westerly side is low and consists of hay meadows with ridges of poplar. A great deal of hay is cut in this part, baled up, and shipped to Winnipeg. In the fall and winter the settlers are all engaged in fishing and large quantities of fish are caught and hauled to Riverton, the nearest railway station. From Riverton they are distributed throughout eastern Canada and the United States. Last season the fishermen were not as successful as usual. The lake was frozen to a depth of about four inches in November, but from that time on heavy falls of snow prevented it from freezing to the usual thickness; thus travel was attended with great danger, many teams going through, and loads of fish were endangered.

Hecla, the post office immediately north of this township, is the point where nearly all of the prospectors and miners pass through on their way to the Rice lake gold mining country. During the season of navigation the best way into this new mining camp is from Selkirk to Hecla by steamer. The Northern Fish company's steamer Wolverine leaves Selkirk every Wednesday and reaches Hecla the same day. From Hecla a sailing boat or gasoline launch may be taken to Bad Throat, and from there a canoe route extends up Manigotagan river to the mining camp. At Bad Throat there is a settlement of Indians who are always ready to furnish canoes and to act as guides. There is a good store at Hecla and also one at Bad Throat where provisions may be obtained at a very reasonable rate, but in going into this camp it would be advisable to buy an outfit at Selkirk or Winnipeg.

I have seen some fine samples of gold-bearing ores from this camp. Up to the present time very little development work has been done, but that little has been so encouraging that one company is spending a large amount this year, and I have no doubt that Manitoba will soon have one or more mines producing gold in paying quantities. The best way into this mining camp in winter is to Riverton on the Canadian Pacific railway and thence by team to Bad Throat.

On October 15, we left Hecla for Bedford, a station southeast of Winnipeg on the main line of the Canadian Northern railway. A number of settlers had squatted on land in that vicinity and made improvements, so that before the land could be subdivided into lots certain preliminary surveys had to be made. The settlers on this land are mostly engaged in the cordwood business, the surrounding country being thickly covered with jack pine, tamarack and spruce and a ready market is found for this wood in Winnipeg.

Our next work was at Sandy Lake, a station on the Canadian Northern railway in the Riding mountains. On account of the beauty of this lake and the surrounding country many summer visitors are attracted, and as some of them had erected cottages on the shores of the lake and wished to obtain patent to the land it was necessary to lay it out into lots.

On November 2, we started for Swan lake, in townships 21, ranges 5 and 6, west of the Principal meridian. On account of unusually dry summers, and the waters to the north being diverted in other directions, this lake which was quite large when the original survey was made had almost dried up. Our work was to extend the lines of subdivision so as to take in the formerly submerged lands.

The settlers in these townships are chiefly engaged in mixed farming. Last year quite a large area was sown in wheat and oats. The cutworm did great damage to the

oats, but the crops were fairly good. The settlers in this part are of many nationalities and appear to be industrious and prosperous.

While on this work the weather was very unsettled, storms and blizzards occurring nearly every day, and as our work was in the open to a great extent, our progress was somewhat slow.

On November 10, I took one man and started for Wymark, while my assistant with the remainder of the party went to Lily Bay to run some lines in tp. 20-7-Pr. This township is along the easterly side of lake Manitoba and owing to the dry seasons the marshy lands had dried up and were yielding large quantities of hay. The lines were obliterated so that there was great uncertainty as to which quarter-sections the hay was on. It was therefore desirable that the lines should be retraced and the corners marked with durable monuments. We also traversed the lake along this township.

My work at Wymark was to place some posts in the easterly limit of the Canadian Pacific Railway yard and move other posts to new positions. I accomplished this work and rejoined the party at Deer Horn on November 26.

We then proceeded to tp. 34-7--Pr. to inspect the work of Mr. J. W. Tyrrell, D.L. S., who was making subdivision surveys along Dauphin river. The country on both sides of this river is level and covered with a thick growth of poplar, spruce and willow. There are many hay meadows and swamps, alternating with poplar-covered ridges of good land which furnish good locations for the settlers. The advantage of settling in this district would be its accessibility by water from Fairford during the season of navigation; in winter good trails lead to Gypsumville. There is plenty of timber for building purposes and fuel, and an abundant supply of hay and water; large game is plentiful in the forest, and the river has a good supply of fish of the best quality. In winter the settler can find employment fishing, and there is a good market with fair prices. On December 17, we returned to Deer Horn with the intention of going east to lake Winnipeg where some work was required, but the trip had to be abandoned as the ice on the lake was not thick enough to carry teams. I therefore proceeded to Brandon where the party was paid off.

On February 10, I again engaged a few men and proceeded to Riverton to re-inspect contract No. 27 of 1913. The snow was so deep that I found that it would be almost impossible to take horses out to this work, so I had to engage two dog teams. I spent a week on this work. In many places the snow was six feet deep, even in sheltered places in the bush, and it was impossible to get along without snow-shoes.

While at Riverton I met a large number of miners and prospectors going to the Rice lake mining country; they were all very enthusiastic about the new mining camp.

The fish business on lake Winnipeg has developed to large proportions. While at Riverton, I saw two hundred tons of fish shipped to points in the United States and eastern Canada. Companies operating in this district supply outfits on credit to settlers wishing to engage in the fishing business, each settler agreeing to sell his whole catch to the company from whom he receives the outfit. When the season is over a settlement is made and generally the settlers have good balances to their credit.

The season was not a very good one for field operations. In September and October we had an excessive rainfall which greatly retarded the work. November was very stormy and blizzards were a daily occurrence in the part of the country in which I was operating.

The snowfall this season has been very great so that field operations in February were carried out under exceptional difficulties.

APPENDIX No. 25.

ABSTRACT OF THE THE REPORT OF S. L. EVANS, D.L.S.

MISCELLANEOUS SURVEYS IN SOUTHERN SASKATCHEWAN.

Our first work was the resurvey of tp. 13-27-2 which was commenced on May 7 and finished on the 25th.

This township lies about twenty-five miles south of the city of Moosejaw and is crossed by the Moosejaw-Expanse branch of the Canadian Pacific railway. The surface is open, hilly prairie and is generally stony. Most of the land has been taken up in recent years, and mixed farming on a small scale is being carried on. There are some large ranches in the township which have proved a successful venture and it would appear that owing to the roughness of the surface, the district is better suited for cattle raising than for grain growing. There is plenty of slough hay throughout the township, and well water is easily obtained.

Our next work was the extension of the subdivision lines across the dried-up portions of the bed of Chaplin lake in townships 15, 16, and 17, ranges 4, 5, and 6, west of the Third meridian. This necessitated a two days' drive across the district north of lake Johnston and by way of Corval. Most of the country travelled through has only recently been taken up, and to the north of lake Johnston considerable areas are under lease for grazing purposes. The soil is generally a sandy loam, and some of the settlers are making fair progress at grain growing.

Chaplin lake, which was shown in the original survey as being about twenty-five miles in length, has in recent years dried up considerably, and at the present time covers only about one-half of its original area. This lake is strongly alkaline and has an average depth of only a few feet. It is gradually drying up from the south, and the portion originally extending into townships 15, ranges 4 and 5, and township 16, range 5, is now nearly dry. The dry bed is covered with a sparse growth of grass, and in a few years it should make good pasture; at the present time it is practically worthless. Some difficulty was experienced in surveying this dried-up lake area owing to the soft ground. The portion of the east half of township 15, range 4, not covered by the lake bed was retraced while we were in that township.

Township 16, range 5 and township 17, range 6, were next retraced and the subdivision was extended over the dried-up bed of Chaplin lake. These townships have a rolling prairie surface and the soil is a sandy loam. They are fairly well settled, and the settlers are making fair progress at grain growing. A few years ago it was generally thought that there was an insufficient rainfall in this district for successful grain growing, and consequently the lands were left open, but they have recently been taken up. During the last few years there has been plenty of rainfall and excellent yields of wheat and oats have been obtained.

The south two-thirds of township 17, range 5, was next traced. The main line of the Canadian Pacific railway passes through this township, and Chaplin station is located in section 29. South of Chaplin the Government have recently built, at considerable expense, two long trestle-bridges across Chaplin lake connecting the island and the mainland. People to the south of the lake are thus afforded a shorter road to market than formerly.

While engaged on the resurvey work around Chaplin lake some retracement work was done at Mortlach, in tp. 17-1-3, for the purpose of obtaining information to assist in establishing the longitude of the Third meridian at this point. This work was completed on August 2.

Our next work was the complete retracement of townships 26, ranges 8,9, and 10, west of the Third meridian. We travelled across country, going by way of Ernfold and Morse, crossing South Saskatchewan river at Log Valley ferry and thence going northwards through the district around Lucky lake. Considerable difficulty was experienced in crossing the river at Log Valley as there is a very soft sandbar in the middle of the river, and the loads had to be transferred from one ferry to another. We were over half a day in getting the outfit across the river. The country north from Morse to the river is a very fine grain-growing district. The land is well settled, and this year splendid crops have been threshed, there being plenty of rainfall.

North of the river through the district around Lucky lake the rainfall was not so heavy. The district is level prairie and the soil is a heavy clay. The lands have been taken up only during the last few years, but fair progress at grain growing has been made by the settlers. At the present time they have long hauls to market, there being no railroad in the vicinity. The Grand Trunk Pacific branch line running west from Moosejaw is in operation as far as Saskatchewan river; west of that the line has been surveyed but has not yet been constructed. When this is in operation this section of the country should become a very large grain producing district.

Townships 26, ranges 8, 9, and 10, are largely in the Coteau hills, and the surface is rolling or hilly prairie. These townships are fairly well settled. In ranges 8 and 9 there are large settlements of Finlanders; these people are industrious and will make first-rate citizens. Grain growing is carried on successfully in the district and some of the rough lands are suitable for cattle raising. From informatioin received from the settlers there has always been an abundance of rainfall since the district has been settled, and this year a bumper crop was threshed, oats yielding one hundred bushels, and wheat as high as forty-five bushels to the acre. The work in these townships was completed on October 8.

We next moved across country to tp. 32-5-3, crossing South Saskatchewan river at Outlook. The country in the Outlook district has been settled for several years and the good class of farm buildings indicate that the settlers have been very successful. Extra large yields of grain were threshed there last year.

The part of township 32, range 5, outside the Dundurn Forest reserve was resurveyed. The land resurveyed is largely sand hills covered with small poplar and scrub. In the south end of the township there are extensive areas of wild hay, and large quantities of pressed hay are put up and shipped to outside points. The settlers in the township are engaged in cattle raising, and this should prove very profitable, as the conditions are ideal, there being plenty of feed, fresh water, and shelter for the cattle.

The east boundaries of sections 25 and 36, township 31, range 6, were also resurveyed. This work was completed on October 29, after which the party was disbanded.

APPENDIX No. 26.

ABSTRACT OF THE REPORT OF S. D. FAWCETT, D.L.S.

SUBDIVISION SURVEYS IN POUCE COUPÉ PRAIRIE, PEACE RIVER BLOCK.

I left Edmonton with my party on May 11, 1915, and proceeded by the Edmonton Dunvegan and British Columbia railway as far as Reno, which was the end of passenger traffic at that time. From there to Peace River Crossing, a distance of about thirty miles, we travelled by wagon, hiring teams for transport. As is usual at that time of year, we found the roads in a very muddy condition.

On May 17, we left Peace River Crossing on board the Hudson's Bay company's steamboat "Peace River", and on the 19th arrived at the mouth of Kiskatinaw river, where by previous arrangement, our pack-train met us.

From this landing a road leads into Pouce Coupé prairie. The first two miles of it, leading up out of Peace river valley is rough, but the remainder is a good wagon road. We hired sufficient teams to haul all our supplies to the neighborhood of our work in one trip.

Our work consisted of the subdivision of townships 77 and 80, range 16 and townships 77, 78, and the eastern two-thirds of township 80, range 17, all west of the Sixth meridian. This was completed early in October and on October 10, I left with twelve men for Fort St. John, travelling over the Government telegraph road which was cut out when the wires were strung from Pouce Coupé to Fort St. John. This is a good road and there are no heavy grades except where the various streams are crossed. The descent to Pine river is the most difficult of these grades, the valley being about 800 feet deep. Pack-horses find no trouble here however and the mail carrier from Pouce Coupé to Fort St. John uses pack-horses to make the trip. Pine river can generally be forded at this crossing, but one must be well acquainted with the normal stage of water, as this is a mountain stream and consequently subject to frequent change in volume.

We arrived at Fort St. John on October 13, and immediately commenced to build a raft with which to travel down Peace river. On the 16th the twelve men left for Peace River Crossing, while I returned with my packer to pick up the remainder of the party and to take the outfit and horses to their winter quarters near Rolla.

We then proceeded to the mouth of Kiskatinaw river where we built a raft, and on October 23, left for Peace River Crossing where we arrived on the 28. We reached Edmonton on the 31.

The soil throughout the townships subdivided is composed of three to eight inches of black loam with clay subsoil. The land is quite suitable for farming purposes.

From May till the latter part of September luxuriant grass for stock is plentiful, and peavine in its season grows profusely. I have heard several settlers say that the upland hay is hard to cure and that there are few hay meadows. However, from the hay stacks observed by us throughout the Pouce Coupé district in the autumn of 1915 it would appear that no great difficulty is to be met with in procuring sufficient hay for stock. A heavy growth of grass is to be found bordering the numerous creeks which occur throughout the country and live stock will fatten rapidly upon it. The largest of these creeks never run dry so that fresh water can always be obtained.

The surface is in general rolling, and is usually covered with poplar from one to six inches in diameter and willow. Some spruce up to twenty inches in diameter grows in the creek valleys and the northern one-third of township 78, range 17, is

covered with poplar, spruce, birch, and tamarack averaging eight inches in diameter Much of the timber, however, in this area has been destroyed by forest fires. Flats of considerable extent are to be found above the slopes of Kiskatinaw river and also in the valley lands following Buffalo creek in the northwestern portion of township 77, range 17, and the southwestern corner of township 78, range 17, and also along Coal brook in townships 80, ranges 16 and 17. These plateau and bottom lands are very suitable for farming or ranching purposes.

Kiskatinaw river runs in a northerly direction through this district. It averages two chains in width and has a current of about three miles per hour. In average water its depth varies from three inches to twelve feet, and it is unnavigable either at this stage or in flood when it becomes a rushig torrent, filled from bank to bank with drift logs, and runs like a mill-race. It then averages from twenty-five to thirty feet in depth. Its banks vary in height from twenty-five feet in tp. 77-17-6, to nearly 300 feet in tp. 80-17-6, and the valley varies from three-quarters of a mile to a mile and a half in width.

The most suitable farming lands lie in the valley of Buffalo creek in townships 77 and 78, range 17, and along the valley of Coal brook in townships 80, ranges 16 and 17. There are patches of prairie up to twenty acres in extent along these creeks and the rest of the surface can be easily cleared, as the timber is nearly all small poplar and willow. Most of the northern two-thirds of township 77, range 17, the southern two-thirds of township 78, range 17, and the southern two-thirds of township 80, ranges 16 and 17, will furnish good farming land except where broken by Kiskatinaw river valley. A beaver meadow, from which a large supply of hay could be cut, is located in section 10, township 80, range 17.

Pouce Coupé prairie, which lies immediately to the east of these townships, consists of rolling and almost open valley lands in its northern and eastern portions and is bounded on the south by a high divide known as Bear hills. These hills are well timbered and will furnish fuel to the prairie for many years.

The farmers are prosperous, but the country is in great need of railway accommodation. It is being settled rapidly and by the time the railway has penetrated this fertile belt there will be few acceptable quarter-sections left vacant.

Vegetables of first-class quality are raised in abundance, and the land is well suited for the production of wheat and oats. In the autumn of 1915, a farmer living near Rolla post office in this district had yields of forty-two bushels of wheat, ninety bushels of oats, and twenty-seven bushels of flax per acre; this furnishes ample proof of the productiveness of the soil. Summer frosts damage crops some years, but this a feature common to all newly-settled districts and will most likely disappear in the course of time. In 1914 the potato crop was a failure due to summer frosts. The prairie is well watered by numerous large creeks.

Large game such as bears, deer, and moose were frequently seen. Rabbits are numerous, but partridges and prairie-chickens are scarce. Red and silver foxes are numerous, as are also beavers, and the homesteaders do considerable trapping on Bear hills and along Kiskatinaw river. Grayling, pickerel, pike, and sucker of small size and in limited numbers can be caught in Kiskatinaw river when the water clears after the July flood has subsided.

Some years there is scarcely sufficient rainfall, while in other years it is excessive. Settlers who are not located on one of the larger creeks have sometimes had to haul water from these creeks, but usually the supply from the smaller creeks is adequate for their needs, and by the erection of dams they can procure sufficient water for stock during the winter. Wells have to be sunk to a great depth before water is obtained.

The climate is usually very agreeable and I have been told by some of the settlers that some years they have been able to work in the fields without coats until well on in December.

There are two post offices in the eastern part of Pouce Coupé prairie, but there is room for another in the west end, as it is fairly well settled; no doubt one will be established there soon.

Settlers going to Pouce Coupé prairie may now travel by train as far as Spirit River settlement. From there, a good wagon road leads south to Grande Prairie and thence northerly along Beaverlodge river to Pouce Coupé. A branch of the Edmonton Dunvegan and British Columbia railway is under construction from Spirit River settlement to Grande Prairie. It is expected to be in operation sometime during 1916.

APPENDIX No. 27.

ABSTRACT OF THE REPORT OF J. A. FLETCHER, D.L.S.

BASE LINE SURVEYS IN NORTHERN ALBERTA.

My instructions for the season of 1915 called for the survey of the 24th and 25th base lines (north of townships 92 and 96 respectively) from the Fifth meridian westerly to the east boundary of range 18.

Upon receipt of these instructions, arrangements were made immediately to have supplies shipped to caches in the vicinity of the 24th base line, one shipment to go by way of Athabaska and Wabiskaw to the intersection of Wabiskaw river and the Fifth meridian in township 91, and the other to go by way of Grouard, north to the neighborhood of Buffalo lake in townships 94 and 95, range 14.

Mild weather came very early in the season and by March 23 most of the snow had disappeared. This made the placing of the Buffalo lake cache impossible. These supplies were therefore ordered to be sent to Peace River Crossing, and arrangements were made on my arrival there to have the Hudson's Bay company take them down Peace river to the mouth of Wabiskaw river. The supplies for the other cache were sent to Pelican on Athabaska river and one small load was got across to Wabiskaw before Pelican river broke up. The remainder of this cache was later taken to Wabiskaw by pack-horses and canoes, and was then sent by canoe down Wabiskaw river to the vicinity of the eastern part of the work. During the handling of the goods they were considerably damaged by water.

All the supplies for the 25th base line survey were purchased in Edmonton, and along with the thirty-one pack-horses were loaded into two cars and shipped to Reno. The party and outfit reached Peace River Crossing on March 30. The weather continued so extremely mild that it was impossible to make the trip down Peace river by sleigh, and we were forced to remain at Peace River Crossing and await the open water.

Eight men were sent north to the 25th base line with the pack-horses, while the remainder of the party repaired the scow left at Peace River Crossing the previous fall. On April 17, the ice having disappeared, the trip down the river was commenced; the scow reached the 25th base line on the 19th almost simultaneously with the pack-train. The survey of this base line was commenced on April 22, and the work proceeded without interruption till the line was completed on July 27. We then moved toward the 24th base following the trail by way of Burnt lake. Where the old trails were not suitable, a fresh trail was made. The survey of the 24th base line was commenced on July 31, and proceeded continuously till its completion on November 2.

On November 3 the party commenced its return to Peace River Crossing. The tamarack swamps were not yet frozen enough to hold pack-horses and while following the trail along the east outline of range 18, the party was kept busy repairing and cutting fresh trail around the soft spots. The trail followed the east boundary of range 18 to the 23rd base line, thence westerly to Peace river, and then southerly in the vicinity of the river to Peace River Crossing, where we arrived on November 10. The next day the party proceeded to Reno, and on the 12th we took the train for Edmonton, arriving there on the 13th, when the party was paid off.

The Fifth meridian is distant 114 miles from Peace river at the 25th base, and in order to keep supplies up with the survey party, it was necessary to place a cache somewhere between these two places. After it was found impossible, through the disap-

pearance of the snow, to place the cache on the 24th base near Buffalo lake, arrangements were made to have these supplies brought in by way of Wabiskaw river. Four canoes were accordingly secured, and five men were hired and placed under the charge of one of my assistants. On April 21, after sufficient supplies were left at the 25th base to last until the line reached Wabiskaw river, these men took the remainder of the supplies in the scow to the mouth of Wabiskaw river and freighted them up the river by canoe. By June 13 enough supplies to last the party to the Fifth meridian were freighted to a cache on Senex creek at the foot of the bad rapids in township 98, and about equidistant between the 25th and 26th bases. For the remainder of the 25th base, supplies were carried from this point by the pack-horses.

Owing to a pressure of their own freight, the Hudson's Bay company had failed to bring further supplies for me to the mouth of Wabiskaw river, as they had promised to do early in April. They also told my assistant that he would have to see to the handling of this freight in person, otherwise it would not be brought down at all. This necessitated a trip by him to Peace River Crossing to ensure receiving enough supplies for the remainder of the survey. These supplies were brought by the Hudson's Bay company's steamer to the mouth of Wabiskaw river, and freighted by canoe to the mouth of Loon river near the 24th base. There are rapids at short intervals most of the way up Wabiskaw river from its mouth. In low water these are quite noticeable and it is difficult to get a loaded canoe over them, the rapids in township 98 being the worst. The supplies from the cache at the Fifth meridian were moved down Wabiskaw river by canoe, about three weeks' supply being sent to range 2, and the remainder to range 4, where they were picked up by the pack-train.

Most of the land passed over will in time make good agricultural land, but in most sections settlement will be slow as there is no ready means of access. Wabiskaw river has too many rapids to make a cheap means of transport, and only in the very high water would motor or steam boats get sufficient depth of water to clear the rocks in the rapids. The country is readily reached by Peace river, but settlers could not very well get inland to suitable locations. The district is well timbered, but from time to time fires have broken out in different sections killing the trees. The lapse of a year or so leaves the surface a tangled mass of windfall. This windfall is quite general over Buffalo Head hills in ranges 10 to 14, and again on the 25th base east of Wabiskaw river.

Numerous small swamps with growths of willow, alder, and tamarack were seen throughout the district; these seem to be the result of old beaver floodings. Quite a number of new beaver dams and ponds were seen during the season, and in some sections the country is extensively flooded. Old beaver meadows are also numerous. Areas of moss-covered ground were quite frequently passed. In some places this moss is two or three feet deep, and where stunted spruce is growing, it does not thaw out all summer. The decayed moss underneath forms a peaty layer with enough moisture to stay frozen. I believe the district could all be suitably drained, and although there are some ridges of light soil, there is generally clay enough to make excellent farming land.

The country northwest of Buffalo lake is mostly level or gently rolling, drainage taking place to the northwest, and the surface is covered with alternate areas of spruce and poplar timber, tamarack swamp, windfall, and moss-covered lands. The soil in this district is generally a good clay or clay loam. On the western slope of Buffalo Head hills, which is quite gradual, there is some land lightly timbered with small poplar and supporting a good growth of grass; this would make good farming land.

The land on the Buffalo Head hills and to the southwest of Buffalo lake is generally rolling, some of the intervals between the ridges being covered with moss and stunted spruce. Most of this region is now covered with windfall or standing dead timber. Lakes and ponds are quite numerous. The soil is somewhat lighter than the lower ground, as indicated by second-growth jack pine on the ridges.

The land between Buffalo Head hills and Loon and Wabiskaw rivers is quite level or gently rolling, and is well timbered along the 25th base with poplar and spruce. From township 94 south, extensive swamps are found with some low ridges of poplar and spruce. Some excellent prairie land covered with grass was found in township 93, range 8. The soil there is a good black loam and will make good farms. Closely adjacent to this fine land are flooded swamp areas which when drained would probably make equally good land. This flat land continues through range 7, adjacent to the 24th base line, and through range 5, adjacent to the 25th base line. The remainder of the country to the Fifth meridian is high rolling or gently rolling land, and is mostly well drained by creeks tributary to Wabiskaw and Panny rivers. The country is somewhat similar to that on Buffalo Head hills and most of it would make good agricultural land if the adverse surface conditions were removed. It is well timbered with poplar and some spruce through ranges 2 to 5, in the vicinity of the 24th base and Wabiskaw river.

Russell, Haig, Talbot and Rossbear lakes on Buffalo Head hills, contain whitefish, but Buffalo lake in the same locality is shallow and has no whitefish. Large flocks of ducks and geese stop to feed at this lake on their migrations north and south. Moose seemed quite plentiful in the district from Wabiskaw and Loon rivers westward to Peace river. Bears were occasionally seen and fur seemed plentiful, beavers, foxes, martens, lynx, mink, weasels and wolves being in evidence. Very few prairie-chickens or partridges were seen.

Some spruce of marketable value was seen along Wabiskaw and Loon rivers and some of the tributary creeks. This timber could easily be floated to the mouth of Wabiskaw river. In other sections there is sufficient timber for building, but on account of the extensively burnt condition of the country no large timber was seen in sufficient quantities to make milling profitable. No coal or minerals were found. Wabiskaw and Loon rivers have numerous rapids which might be developed for power should a market arise.

The climate during the season of 1915 was very fine, as is usually the case in this country. The rain was sufficient to satisfy all needs of growth, but was not excessive. The country was becoming quite dry in early July, and forest fires were seen in several directions. These, however, were stopped by some good rains about the 10th. About an inch of snow fell on September 10, while the party was at Loon river, and snow was quite frequent on Buffalo Head hills in October.

APPENDIX No. 28.

ABSTRACT OF THE REPORT OF W. A. FLETCHER, D.L.S.

STADIA SURVEYS IN YORKTON DISTRICT.

The season's work consisted of the continuation of the stadia traverse and investigation of lakes and sloughs in the Yorkton district, and the establishment of monuments at corners where the presence of water had prevented their erection at the time of previous surveys.

Work was begun in tp. 27-14-2 on June 1, 1916, and the investigation, urgently required, of eight townships in this locality, was completed by the middle of September. We then moved to Pelican lake in tp. 32-10-2, and after completing the work in this township and in tps. 31 and 33-10-2, left for tp. 26-1-2, which we finished on October 30, thus completing operations for the season.

The district investigated this year presents much variety. In some townships all the road allowances are open and graded, while in others large water areas block up the roads, and as in many cases the land surrounding the water is low and wet, no attempt has been made to construct roads around the obstructions.

On the south side of Sandy lake in tp. 32-10-2, there occur large sand dunes, about six feet high, which have been thrown up by the wind and waves. These dunes are about eight feet wide on top, being grown over with willow and poplar. When the water in the lake is high it escapes through openings in the dunes flooding the land behind.

Poplar grows almost everywhere, but never to a greater diameter than six inches, except in small patches. The surface, which is level prairie to the south, becomes rolling farther north. The soil is good, though often very stony. Good crops are raised where the land can be easily cultivated, but in the stony and rolling areas where hay is abundant ranching is followed.

Small game, both of the fur-bearing and feathered varieties, is plentiful.

APPENDIX No. 29.

ABSTRACT OF THE REPORT OF L. E. FONTAINE, D.L.S.

INSPECTION SURVEYS IN NORTHERN ALBERTA.

My 1916 surveys were not commenced till late in the season. I reached Edmonton on August 11, and while my supplies were being prepared for shipment I proceeded to High Prairie to arrange for winter-quarters for the horses of the different parties operating in the vicinity of Lesser Slave lake.

On my return to Edmonton I organized my party, and on August 23 we left to inspect the townships subdivided by Mr. H. E. Pearson, D.L.S. This work was completed on September 6.

We then proceeded to High Prairie, and used this place as a base while inspecting the surveys of Messrs, D. F. McEwen, D.L.S., and A. E. Glover, D.L.S., which were located to the south and southwest. This work was completed on October 17.

From High Prairie we returned by train to Westlock in tp. 59-26-4, and thence travelled by trail to the townships surveyed by Mr. A. Lighthall, D.L.S., west and north of Holmes Crossing in tp. 61-5-5. The trail as far as Holmes Crossing is well graded and in good condition. We completed the inspection of this survey and arrived back in Edmonton on November 20, when the party was paid off.

Throughout the districts visited the soil is mostly fair, but except in isolated spots the land is more or less wooded and will require clearing. Improvements were noted everywhere and all of these districts have been benefited by the operation of the Edmonton Dunvegan and British Columbia railway, which gives access to the markets.

APPENDIX No. 30.

ABSTRACT OF THE REPORT OF J. S. GALLETLY, D.L.S.

SUBDIVISION SURVEYS IN NORTHERN MANITOBA.

Owing to the wet nature of the district in which my work lay it was decided to postpone operations till late in the season. I left Pas with my party on August 4, 1915, and, travelling via Hudson Bay railway and thence across Cormorant lake by canoe, we reached our first work in tp. 60-24-Pr. south of Cormorant lake.

A portage one mile long connects this lake with Atikameg lake, but a creek can be used for three-fourths of the distance with lightly-loaded canoes. The shores of both lakes are high and rocky, and landing places are scarce.

By December 14 we completed the surveys in tps. 59 and 60-23-Pr. and tps. 58, 59, and 60-24-Pr., except the traversing. Leaving my assistant and three men to complete this work I went to Pas with the remainder of the party to perform some surveys in connection with Indian reserves and a settlement on Carrot river.

Completing this work on February 19, 1916, we began the subdivision south of Saskeram lake from range 26 to range 30 inclusive.

The townships between Cormorant and Reader lakes are easily reached from Pas by the Hudson Bay railway and thence by boat to the desired township. In winter there is a trail from Pas to Atikameg lake and from this the surrounding townships can be reached by travelling over the ice. Carrot river settlement can be reached in summer by steamboat, and in winter one could take a team to almost any lot yet surveyed with very little cutting.

Between Cormorant and Atikameg lakes the soil is nearly all fourth class, being usually rocky or swampy. In Carrot river settlement the soil is a first-class clay loam, the result of sedimentary deposit from the flooding of the rivers of the district. There are a number of lakes and marshes here most of which would permit of drainage into Carrot river when the latter is at low water. As clay appears in the bed of these lakes and marshes it may be assumed that the beds of such areas as would be reclaimed would become in time first-class soil also. There is practically no stone in this locality. The soil there will grow all the grains and vegetables grown in the province, and some of the products of the district which have come under my notice were very fine indeed.

Limestone is abundant between Cormorant and Atikameg lakes, and a few boulders of granite and gneiss were seen there also, but beyond this no mineral was found.

Game is not very plentiful, as we saw only a bear, a moose, some ducks and goose, and a few foxes and wolves; the district is too close to the railway and to civilization.

Scrub spruce, poplar, jack pine, tamarack and willow constitute the main growth between Cormorant and Atikameg lakes, and they cover the whole surface leaving very few open spots. Occasionally the timber gets larger, and along the shores of Atikameg lake a settler would find logs suitable for building. In tp. 59-23-Pr. there is a belt of timber which if given time would make a very nice limit. At present the timber is for the most part small but it gives indication of good growth and would be worth preserving. Spruce predominates but there is also some good poplar. Along Carrot river one finds a thick growth of willow which is partly replaced by balm of Gilead, maple, and ash as one ascends the stream. This growth is confined to a narrow strip along the river but ridges of thin willow extend between the lakes.

No hay could be cut in the townships between Cormorant and Atikameg lakes, but there are numerous hay meadows along Carrot river and in a dry season several

thousand tons of hay could be put up. Almost every settler in Carrot river settlement would be sure of some hay land, for every lot contains some, and the yield is very large.

The climate does not differ much from that of other parts of the three western provinces of the same latitude. During last winter we were troubled with strong winds, as we were often working in the open, but in a bush country these would not be noticed.

I saw horses belonging to a settler on Carrot river, which passed the winter in the open, and they were in good shape in the spring. They were fed hay, but I saw them pawing in the frozen marshes. Last winter was generally considered a pretty severe one and it would therefore appear, that, given the right class of animal, horses and cattle could rustle most of the winter, or at least would only require to be fed hay during the winter months, and the settler would not be under the necessity of erecting costly buildings.

Fishing has been carried on to a considerable extent in Cormorant and Reader lakes, whitefish, trout, jackfish, and pickerel being obtained there, but these lakes are now somewhat depleted and no fishing is being done in them.

Cormorant lake is reached by the Hudson Bay railway which crosses the lake at a point called "the narrows" about forty-two miles from Pas.

The lake is about eighteen miles long and twelve wide, and is broken up by a number of large islands. The water is clear, potable and usually deep but in tp. 60-23-Pr. there is a shally stretch between some islands and the shore. The shores are rocky and in many stretches the limestone rises vertically out of the water to a height of from fifteen to twenty feet, and there the water is deep close to shore.

Atikameg lake is more popularly known in the district by the name of Clearwater lake, and is connected by a small stream to Cormorant lake. There is a fall on the stream of about twenty feet at Cormorant lake, but there was no water flowing last August. This lake is larger than Cormorant lake, and in the part surveyed it has only a few small islands. As a result of this a light breeze will raise quite a sea, which makes the lake dangerous for small boats. It is, however, quite safe for large power boats and sail boats. The shore is low, but stony with occasional sandy beaches, and the land rises gently as one goes inland. The water is deep, very clear and good to drink.

Carrot river is about three chains wide, and is navigable for about one hundred miles from Pas in high water, and for about fifty miles in low water. Four settlers were found there at the time of the survey, and on a recent trip to Pas, I found six more, who were waiting until the river was clear of logs, and who were coming to settle on the lands surveyed. The land there is liable to flood, but though the settlers know of this they are satisfied that in spite of that it will be worth their while to take up land in the district. The soil is first class with many fine open hay meadows, and except for the possibility of flood, there is everything to attract the settler. Summer frosts are few and their effect will be nullified when the land is broken up.

No coal or lignite is found in the district and we had difficulty getting a supply of dry wood, but a settler could overcome this by cutting his wood supply ahead of time and allowing it to dry.

Another item of interest to settlers is that a large new school has been erected at Pas, and it is the intention of the authorities to conduct a high school there in addition to the regular public school, when conditions warrant their doing so.

Mining has aroused a keen interest in the district northwest of Pas. Valuable deposits of copper sulphide have been found at Flin Flon lake and at Schist lake, while the gold discoveries at Herb lake and Little Herb lake are also considerable. Drilling is in operation on the Flin Flon properties and also at Schist lake. It is expected locally that this summer will see considerable development in the mining industry there.

APPENDIX No. 31.

ABSTRACT OF THE REPORT OF JAMES GIBBON, D.L.S.

SURVEYS IN THE NEW WESTMINSTER DISTRICT.

My work for the season of 1915 was commenced in tp. 2, W.C.M., where preliminary surveys were made of parts of sections 9 and 20, with a view to subdividing them into small holdings later on. Part of the Vancouver Power company's right of way through this township was also surveyed. Most of the heavy timber has been removed from this township, but there is still sufficient light timber left to make the cutting of shingle-bolts, ties, wood, etc., fairly remunerative. The soil is best suited for mixed farming and gardening purposes.

On completion of these surveys we moved south to sec. 23, tp. 1, W.C.M., and began the survey into legal subdivisions of sections 14, 15, 17, 21, 22, 23 and 24. These sections are situated on a ridge from 200 to 300 feet in height between Nicomekl river tide flats and Semiamu bay. This ridge was originally thickly wooded with large cedar, spruce and other timber. The greater part of the fir and cedar has been removed by lumbering operations followed by heavy bush fires, but there still remains a considerable quantity of large fallen cedar which is being cut up into shingle-bolts. Small plots are being used for growing garden produce and small fruits but the work of removing the large fir stumps is too costly for the ordinary settler.

Our next work was to lay out secs. 17 to 21, tp. 7, E.C.M., into legal subdivisions. These sections lie on an extension of the ridge crossing tp. 1, W.C.M., and the land is similar in character.

On July 7, we moved back to tp. 2, W.C.M., where we completed the subdivision of the northwest quarter of section 20, and the southeast quarter of section 9, and on July 20, moved to tp. 14, E.C.M., where we surveyed section 36 into legal subdivisions. The latter section seems best suited for fruit growing. We also surveyed several small islands in Fraser river adjacent to the east boundary of the township.

Our next work was in the vicinity of Morris lake, in tp. 4-29-6. The Government has constructed a fish trap at the point where Morris creek flows into the lake for the purpose of securing salmon spawn to supply the Government fish hatchery on Harrison lake. The main industries of the district are fishing and lumbering but the soil seems to be well suited for fruit growing.

On August 24, we moved to tp. 3-29-6 where we resurveyed several islands in sections 15, 16, and 17 and traversed part of the south bank of Fraser river. These islands are formed principally of river silt and consequently the soil is especially suited for agricultural purposes. Apples, pears, plums, and the smaller fruits grow in abundance in this district and hop growing is one of the chief industries.

Our next move was to sec. 22, tp. 3-30-6 which was partly surveyed into legal subdivisions. This section is situated on a high rocky ridge between Harrison bay and Fraser river and very little of it is suitable for agriculture. From this camp we also traversed part of the south bank of Fraser river and several islands in the vicinity.

Camp was then moved to an island in section 10 of the same township, from where the traverse of the south bank of the river and adjacent islands was continued. Some of these islands are of little value except for pasture, as the deposit of silt on their surface is not yet very deep. From this camp we also surveyed the southwest quarter of section 16 into legal subdivisions.

On October 15, the main party was disbanded, and assisted by one man only I completed the work in this vicinity. I then proceeded to tp. 22, E.C.M., where some of the section lines in the vicinity of the international boundary were retraced. This part of the township is rough and broken and is best suited for pasture lands.

On October 29, I closed operations and returned to Vancouver.

The lands in the vicinity of the lower Fraser river are mostly composed of alluvial soil and are very fertile. The district is also rich in timber. The canning of salmon is one of the chief industries, millions of pounds being put up annually. Salmon fishing is permitted for some thirty miles up Fraser river; above that the fish are protected in order that they may reach their spawning grounds. The spawn for the Government hatcheries is gathered from fish caught in traps. After the fish are hatched they are allowed to go free to re-stock the waters.

No coal or other minerals were found and no water-powers were noticed during our survey.

The climate in the district covered by my surveys is sufficiently moist to render irrigation unnecessary although the past season was exceptionally dry. The months from November to February inclusive constitute the rainy season.

APPENDIX No. 32.

ABSTRACT OF THE REPORT OF A. E. GLOVER, D.L.S.

SUBDIVISION SURVEYS SOUTHWEST OF LESSER SLAVE LAKE, ALBERTA.

My work for the season of 1915 consisted of the subdivision of townships 71 and 72, ranges 20 and 21, and part of the township 72, range 19, all west of the Fifth meridian.

This district may be reached by either of two routes. One is the winter road from High Prairie, a station on the Edmonton Dunvegan and British Columbia railway, to Snipe lake, and thence northwesterly by pack-trail. The other route is from Aggie siding to Little Smoky river in tp. 72-20-5. The latter route was the one used by my party.

Before commencing the season's surveys I had a cache of provisions established at Aggie but as the trail from there to the vicinity of our work crosses a very flat country with poor drainage, and is consequently never in good condition in the summer, it was decided that it would be impossible to pack supplies in with our pack outfit. Arrangements were accordingly made to have all the supplies at this cache freighted to our first camp in tp. 72-20-5.

Another cache was established at High Prairie for use during the latter part of the season. This was entered during the summer and robbed of our most valuable supplies.

Work was commenced in the field on May 7, in tp. 72-20-5 and was continued without interruption till October 17, when the season's operations were closed.

All of the townships surveyed with the exception of tp. 71-20-5, are covered by a dense growth of spruce, poplar, willow, and alder. The soil is good and has good natural drainage for about ten miles on each side of Little Smoky river. The land is fairly level with the exception of the river valley which is rough.

The surface of tp. 71-20-5, is lightly wooded with willow, alder, and scrub poplar, with many open spaces. It will make excellent agricultural land and will be easily cleared. There are no settlers in this district yet.

Game, such as moose and bears, is very plentiful.

No summer frosts were noticed.

APPENDIX No. 33.

ABSTRACT OF THE REPORT OF R. V. HEATHCOTT, D.L.S.

SUBDIVISION SURVEYS NORTHWEST OF PEACE RIVER CROSSING.

My work consisted of the subdivision of townships 85, ranges 24, 25, and 26, west of the Fifth meridian, and townships 83, 84, and 85, range 1, township 83, range 2, and the northerly one-third of township 82, range 2, all west of the Sixth meridian.

From Peace River Crossing we proceeded by the Dunvegan wagon road as far as the Catholic mission, in tp. 82-23-5, thence by the Whitemud wagon road around the east end of Bear lake and thence northerly into the southeast corner of tp. 85-24-5. This is the best route into this township and the townships west of it. The shortest route into the other townships subdivided by me is the Dunvegan wagon road to Bear Lake post office in tp. 83-24-5, and thence northwesterly to the west end of Bear lake, where the road branches, one branch going north into tp. 85-26-5 and the other due west; both of these are good.

My outfit consisted of two heavy teams and fifteen pack-ponies. The teams were used for bringing in supplies and moving the main camp, and the pack-ponies for moving camp and also for taking fly camps to finish the portions of the work farthest away from the main camp, thereby saving considerable time in cutting trails. We were able to use wagons all through our work, being fortunate in finding roads which required comparatively little work to open up.

After completing the survey of tp. 85-24-5, we worked west to tp. 85-1-6, and then south, finishing in tp. 82-2-6.

The country is gently rolling, and most of it has been burned over and is now covered with light bush. The remainder is heavily timbered, excepting the northern portion of tp. 85-1-6, which is heavily rolling and forms part of the Whitemud hills.

There is plenty of water in the numerous small creeks, and in the shallow lakes, of which there are a large number in tp. 83-1-6. The soil consists of black loam with a good clay subsoil, and is most suitable for mixed farming. It will probably be very rapidly settled, though there were at the time of my survey only six squatters, these being located in tp. 83-1-6; one of them had a fine crop of oats.

The country immediately to the south and east of this district is known as the Bear Lake settlement. It is well settled, and grain growing and market gardening have been carried on with marked success.

We completed our work on September 30, and proceeded to Edmonton, where the party was disbanded.

APPENDIX No. 34.

ABSTRACT OF THE REPORT OF G. H. HERRIOT, D.L.S.

BASE LINE SURVEYS IN NORTHERN MANITOBA.

My instructions for the season of 1915 called for the survey of part of the 15th base line (north of township 56) west of the Principal meridian, but owing to the wet nature of the country crossed by this line, it was decided not to begin work until after the freeze-up. Supplies for the work were cached at suitable points during the summer and the party was organized at Pas on November 10.

The survey of the base line was begun at the NE. cor., tp. 56-25-Pr., but the line of levels run in connection with the survey had to be commenced at a point about seven miles farther west.

It was therefore necessary to organize a small advance party to do this work. Accordingly on November 11, the third assistant with three men and two dog trains and drivers were sent out to commence this line of levels, and several days later the main party proceeded to the starting point of our regular survey work.

On November 16, the production eastward of the 15th base line was commenced from the northeast corner of township 56, range 25. Although the first twenty-four miles of our work consisted of resurvey, it was found that within the first range we had passed completely out of the old cutting. The country throughout these ranges is largely an extensive willow swamp, the willow in places being large and very dense, and in other places small and scattered. Where the willow were small, little or no trace of the old line could be discerned, and where they were large, the fact that the old line had been poorly opened out, and the willow that had been cut had been allowed to hang up in the others along the side of the line, meant that our line which ran along the north edge of the old line, was much harder to open than if the survey had been original.

Throughout the first part of the season, the supplies and dog feed were for the most part hauled from Pas, but whenever fish were available on Saskatchewan river closer than the town, we took advantage of the opportunity and purchased them for the dogs. Most of the dog feed used on this first section of the line consisted of cornmeal and tallow, as fish in quantities was not available. The dogs during this period steadily lost flesh, owing to the unsatisfactory food, and to the fact that they were still soft.

The production of the base line was continued eastward with the utmost expedition, until on December 3, it was discontinued in section 36 of range 20. The following day the east outline of range 21, was turned off to the north and its survey commenced. On the 13th we moved north to the 16th base, and next day turned the east outline of range 21 off that base to the south, and commenced its production southward. The work of extending this line across township 59 and part of township 60 was rapidly carried on owing to the extensive open swamps met. On December 20 the outline was completed and the camp was moved back to the 15th base in range 19.

On the following day the survey of the base line was resumed and the work carried forward with all possible speed until, on February 29, our survey was connected with the NE cor. sec. 35, tp. 56-4-Pr. on the eastern side of Playgreen lake

Throughout the period of the survey extending from about December 10 until about January 22, we drew our supplies from a cache which had been placed at Moose Lake post. From the latter date until we arrived within hauling distance of Playgreen lake we hauled our supplies from caches on Limestone bay.

Throughout the period from December 1, until the conclusion of the survey, fish were used entirely for dog feed. Most of the fish were hung whitefish that had been put up for me at points on Moose and Playgreen lakes. The hung fish have a great advantage over green fish for dog feed, especially if there is any haul; they are much lighter and seem to contain greater nourishing qualities. However, an occasional change to green fish is to be recommended as it keeps the dogs in a healthier condition. The dogs at once began to improve and at the close of the season, with one or two exceptions, were in excellent shape, in spite of their hard season's work.

Weather conditions throughout the first part of the season, until January, were very fine for survey work. The snowfall was heavy enough to afford good trails but not so deep as to interfere with the progress of the work, or to necessitate the use of snowshoes. But from early in January until the end of February, the weather was very severe, the temperature ranging around 40 to 50 degrees below zero for several days. The depth of snow steadily increased so that early in January most of the line men were compelled to use snowshoes. Strong winds were very prevalent throughout the months of January and February, repeatedly filling up our trails. However, notwithstanding the severity of the weather and the frequent storms, we did not lose a single day on the line.

Description of the country traversed by the survey.

An extensive willow swamp with practically level surface extends across the easterly five miles of range 24; the soil is black loam and the ground is very springy. To the east of this swamp are some jack pine ridges and farther east in range 23 are more swamps which are impassable in summer. North and south of these swamps, however, are extensive jack pine ridges. Lakes are numerous along the line as far east as range 22 and in this range are ridges of clay loam and boulder clay. From there to Moose lake in range 21 the surface is low. This low land is flooded at high water, but it will probably be only a few years till this area will be marsh land. Near the shore of the lake is a bluff about thirty-six feet above the surrounding land. It consists of gravelly clay on limestone, on which grow spruce, poplar and jack pine up to ten inches in diameter.

Moose lake is of such an extent and so irregular in contour that it almost defies description. However, a few general remarks can be made. It is as a rule, quite shallow with deep areas in only a few places. Whitefish, jackfish, and sucker are to be caught in its waters, but only fishermen who are familiar with the waters were successful in making a fair catch last winter. The most easterly arm of Moose lake in range 16, is well known for its fine lake trout and large whitefish, but Government restrictions had closed this area of the lake throughout last winter. The lake may be considered to be made up of four different sections: the two main sections lying one north of the narrows, which is just about two miles north of the base line in range 19, and the other south of the narrows. The northern section extends almost twenty-two miles north, in ranges 19 and 20, with a width varying from four to ten miles. The southern section extending in parts nearly fifteen miles south, is roughly, the shape of the bottom of a bag with a huge triangle extending into it from the north for a depth of about seven miles. East of this projecting point lies the eastern arm. Its shape is roughly that of a rectangle, four or five miles wide and probably sixteen miles long. It is connected with the main lake by a channel only a couple of chains wide, through which a very marked current flows. The westerly arm which we first encountered in range 21, is quite irregular in shape and is perhaps shallower than any of the other

sections. It is about seven miles across each way and is connected with the main lake by a channel less than a quarter of a mile wide. A number of very densely-wooded islands occur throughout the lake; one especially large one, lying about eight miles south of the base line in range 19, has been set apart as Indian Reserve No. 31 C.

The part of the base line across ranges 20 to 16 is therefore badly cut up by the various arms of the lake. The intervening peninsulas are mostly well timbered with spruce which in places is from eighteen to twenty-four inches in diameter. Most of the good timber is included in timber berth No. 1108.

Egg lake lies north of the line in rage 17. It extends about eighteen miles northerly from the base line, and is about eight feet higher than Moose lake which is within a quarter of a mile of it at one point. Whitefish are very plentiful in it.

In ranges 15 and 14 the surface is slightly rolling and mostly covered with fire-killed timber.

Igneous boulders were occasionally met with in range 14, although no such rock was anywhere found in place. Here a most peculiar phenomenon of holes in the limestone bedrock occurs. The holes are from four to six feet deep with more or less circular and enlarged bottoms. The walls are quite firm, fairly perpendicular, and not at all weathered. The limestone here is lying perfectly flat. Quite a few of these strange holes were seen, occurring singly and in groups close together. From their formation it would appear as though water had been imprisoned at the time of some fire and that the intense heat had converted the water into steam which produced an explosion and blew out the limestone, thus creating the holes.

William lake in range 13 extends about eleven miles south of the base line and about thirteen miles north. The shore is rocky and rises considerably above the water level. The water was low at the time of our survey and fish were not plentiful. East of this lake spruce and jack pine muskegs are numerous with intervening ridges. These ridges are in reality, terraces of a long gentle slope towards lake Winnipeg. The fall at each of these steps is approximately twenty feet, while the muskegs also have a gentle slope eastward.

Limestone bay lies about a mile south of the base line in ranges 9, 10, and 11. It is an extension of lake Winnipeg and is very shallow, being not more than five feet deep at any point.

From there to Playgreen lake in range 5 the surface is level and consists principally of tamarack and spruce swamps.

Playgreen lake is really an expansion of Nelson river. It is about fifty miles long and roughly four miles wide. This lake is connected with lake Winnipeg by about a three-mile stretch of Nelson river. Numerous small rocky islands appear above the surface throughout the lake, while many do not rise high enough to form islands but occur as submerged reefs. The water is generally very shallow. From these facts it is apparent that only shallow-draft boats can be used on the lake and then only with a pilot thoroughly acquainted with the reefs. No attempt whatever is made to travel the lake at night. The Northern Fish company's boats that have been navigating Playgreen lake are screw boats with a draft of less than six feet, and not infrequently they run aground. This body of water is traversed by boats running between Warren Landing south of the base line, and Norway House and Whiskey Jack portage north of it. Whitefish, sturgeon, jackfish, pickerel and sucker are very plentiful in the waters of this lake.

The country along the east outline of range 21, between the 15th and 16th base lines is largely willow swamp with patches of spruce and tamarack. A ridge of dense timber, consisting of spruce, balsam, jack pine, poplar, and birch up to ten inches in diameter extends along the north shore of the west arm of Moose lake in township 57.

The country in the neighbourhood on the 15th base line is easily accessible. The eastern end of the line may be reached by boat across lake Winnipeg to Warren Landing and thence down Nelson river and Playgreen lake. Ranges 10 and 11 can be reached

by boat from Warren Landing to Limestone bay. The western end of the country covered by our survey is within easy reach of Pas, Manitoba, and the district in the vicinity of ranges 21, 20, 19, 18, 17, or 16 can be readily reached by travelling by boat or canoe down Saskatchewan river from Pas to Moose lake. The country in the vicinity of the east outline of range 21, in townships 59 and 60 is within easy reach of the Hudson Bay railway at Cormorant narrows.

Resources of the country.

The resources of the country covered by our surveys are very few indeed. Practically none of the land will be suitable for cultivation until after it is drained. Where the land is already sufficiently dry, the soil is a clay, carrying limestone fragments, which makes it unsuitable for growing crops.

Certain areas bordering on Moose lake however would be suitable for stock raising as the growth of slough grass over these sections in 1915 was quite luxuriant, but a great portion of this area is liable to be badly flooded during high water. At Moose Lake post the trader keeps quite a number of cattle and horses. The Indians also have a few head of stock. It is necessary to put up an abundant supply of this slough grass for winter feed and to stable the stock in the winter as the weather is too severe to allow them to run at large, and the frozen grass on the swamps has little or no nourishment, besides being covered by two to three feet of snow.

Very little merchantable timber was meet with during the survey. That included in timber berth No. 1108 has already been mentioned. A small island in William lake that has escaped the recent fire carries some fine spruce. A fringe of fair spruce timber borders Limestone river in range 11 at about eight or nine miles north of Limestone bay, but I have no information as to the probable extent of this patch of timber. Some very fine belts of timber suitable for pulpwood are to be found, especially around Moose lake. The fire of 1915 has destroyed great quantities of timber that would have made excellent pulpwood.

Of the many lakes in this locality, Moose and Egg lakes are the only two in which commercial fishing is carried on. Quite a number of tons of whitefish were taken last winter on Moose lake. Those caught in the northern part of the lake were hauled to the Hudson Bay railway at Cormorant narrows and shipped into Pas, while those taken on the lower part of the lake were hauled by teams to Pas. Only two or three fishermen were engaged on Egg lake, and from all reports they had a fair catch. These fish are also shipped to Pas. Fishermen who have fished on Moose lake for a number of years claim that the size of the catch taken on this lake is getting smaller each year. Whether this be due to depletion of the fish in its waters through fishing or to the dying off of the fish, owing to the lowering of the waters of the lake, is uncertain, but it is certain that the water level has fallen two feet or more since 1911.

Fur-bearing animals are by no means plentiful throughout any portion of the district traversed, although a few local sections were crossed where one or two kinds of fur-bearing animals were apparently numerous. Signs of foxes, lynx, beaver, mink, marten, wolves, both timber and brush, and weasels were observed. In the district north of Limestone bay signs of lynx were frequently seen.

Moose are quite numerous around Moose lake and northeast of Limestone bay, while the snow between Moose and William lakes was much tracked up by caribou. Rabbits, ptarmigan and partridges were very scarce.

Settlement.

Three small settlements lie within a few miles of the base line. The first of these at Moose Lake post is probably located in range 20 at about ten or twelve miles south of the base line. It comprises Indian reserve No. 31 on the west shore of Moose lake and the land occupied by a few squatters. Both Revillon Bros, and the Hudson's Bay

company had posts here, but in recent years these have been closed up. A trader who owns a small store keeps quite a number of horses, cattle, and pigs. Two schools are conducted at the post, one for the non-treaty Indians and white children, and the other for the treaty Indian children. A fire ranger is also located here throughout the summer.

The trader and the Indians have made little or no attempt at cultivation of the land, although they have small gardens and are able to raise some of the hardier vegetables, such as potatoes, cabbage, lettuce, peas, and radishes. I believe that if the land were cleared, drained and cultivated, excellent oats and barley could be grown.

Near the eastern end of the base in range 3, Norway House, with the adjoining Indian reserve No. 17, and Rossville mission, lies about eight miles north of the line. Several trading stores are conducted here. Norway House with its location on Nelson river and Little Playgreen lake is a very picturesque spot. Moreover, it is historically important as it stands on the old route between Hudson bay and the interior of western Canada. An English church and Methodist mission look after the moral welfare of the Indians, and the Methodist mission with the aid of the Government, has erected a large boarding school for the Indians. A very fine hospital has also been built. The native population hunt, trap, and fish for a living during the winter, and in the summer those that are willing and able to work find employment around the missions, the trading stores, or in freighting or tripping on Nelson river. Little attempt has been made at agriculture, and only enough garden produce is grown for local needs. All the hardier vegetables can be grown.

In range 4, about thirteen mile south of the line, Warren Landing is situated. This is nothing more than a fishing and freighting station. It is situated at the north end of lake Winnipeg at the point where Nelson river flows out of the lake. On each side of the mouth of the main channel of the river is located a dock, fish-house, ice-house, and warehouse together with the different buildings for the fishermen, including dining and sleeping quarters. For about two months in the summer this point is a busy place, alive with men. During the remaining months of summer there is a stir only when the lake boats from Selkirk arrive with their passengers and freight. A few families of half-breeds live near the landing. These are employed during the summer, handling the freight from the boats, and in the winter months, they hunt and trap, and assist with the putting up of ice for the following summer. No attempt has been made to cultive the land, which is found to be largely muskeg after one gets back from the sandy margin of the lake. Very little garden produce has been grown here.

On March 8, 1916, we commenced the retracement of the 15th base line westward from the NE cor. sec. 36, tp. 56-25-Pr. The line had been partially opened in the fall in order that we might carry our levels from the Hudson Bay railway to the point of commencement of our original survey, so that it was not necessary to do much further opening across range 25, nor was it necessary to run levels again over this section of the line.

Rapid progress was made on the survey as the line crossed two extensive open stretches on Reader and Saskeram lakes. Here the transport outfit was very busy as we moved camp every day. On March 20 we completed the retracement as far west as the Second meridian, and the following day returned to Pas.

APPENDIX No. 35.

ABSTRACT OF THE REPORT OF E. W. HUBBELL, D.L.S.

INSPECTION SURVEYS IN NORTHERN ALBERTA.

My field work, which lasted from early in September till the beginning of December, consisted of the inspection of subdivision surveys bordering on Athabaska river north of McMurray and along the right of way of the Alberta and Great Waterways railway south of McMurray.

Leaving Athabaska on September 16, we travelled down Athabaska river by scows reaching McMurray on the 22nd.

The celebrated tar sands cover a large area along Athabaska river, commencing at tp. 87-14-4, and extending about seventy miles north of McMurray; they are very conspicuous in places, especially at the mouths of rivers and creeks. Up to the present no development work on the tar-sand district has been undertaken, and it is therefore impossible to estimate the value of these immense areas, which authentic reports place at 700 square miles.

McMurray is beautifully situated between Athabaska and Clearwater rivers. Its population varies from 250 to 400. There are several good stores, three boarding-houses, one hotel, a Roman Catholic mission, post office, telegraph office, Hudson's Bay Company post and a portable saw-mill which has an output of from 8,000 to 10,000 feet per day.

North from McMurray, the river broadens out, the banks become gradually lower, and there are no rapids, although for fifteen miles the current is quite swift, being from five to six miles per hour. Many islands, mostly wooded, are met with and also numerous sandbars.

On September 28, we commenced the inspection of Mr. J. C. Baker's subdivision, finishing on October 5. No settlers were found in this district, except at McKay and vicinity, where there are a number of half-breeds and a Hudson's Bay post. From there we moved camp to tp. 101-9-4, and commenced the inspection of Mr. J. W. Pierce's subdivision, finishing on October 9.

Returning by boat to McMurray we moved by trail to tp. 88-7-4, where we commenced the inspection of Mr. Knight's subdivision and from there worked southerly into Mr. Waddell's survey, closely following the grade of the new Alberta and Great Waterways railway; the latter inspection was finished on November 17.

The country along this railway is mostly muskeg covered with small tamarack and spruce. There are however numerous ridges and isolated patches of good land, which are covered with spruce, poplar, birch, jack pine, tamarack, windfall, brule, and scrub. Plenty of good water is to be found in the small rivers, creeks and lakes. Very little hay land was noticed; in fact it is rather difficult for horses to obtain sufficient fodder in the summer, for their sustenance. Only a small percentage of the timber is adapted for manufacturing purposes, but there is plenty suitable for railway ties, fence rails, etc. When the railway is completed, transportation to McMurray and vicinity will be comparatively easy and much cheaper than at present, and the present water route will be abandoned.

The soil in the timbered areas consists of vegetable sandy loam, with clay subsoil, apparently suitable for agricultural purposes, although considerable clearing is necessary before it can be rated as land fit for cultivation. Game is plentiful, especially moose.

There are no settlers throughout this district, and until the muskegs are drained there is but little chance of there being any.

APPENDIX No. 36.

ABSTRACT OF THE REPORT OF J. H. JOHNSTON, D.L.S.

SUBDIVISION SURVEYS EAST OF PEACE RIVER CROSSING.

My survey operations during the season of 1915, consisted of the subdivision of the north third of township 82, and all of townships 83, 84, 85, 86, and 87, range 19, and township 84, range 20, all west of the Fifth meridian.

I left Peace River Crossing, where my party was organized, on May 10, and proceeded by way of the Grouard trail to "Little Prairie", a distance of thirty miles; the road had just broken through and was in bad shape. From there we went north to township 82, range 19, on a trail which I had previously made in order to freight supplies from Reno. This trail which follows the north branch of North Heart river, passes through some very fine open country. This is a continuation of the "Little Prairie" district, the soil of which, according to tests of the Provincial Department of Agriculture, is among the richest in Alberta.

The first camp was in section 26, township 82, in open prairie, where the new grass was growing very rapidly. I brought with me thirty-five bushels of oats, which with careful distribution lasted until the grass was more abundant, and the pack-horses, twenty in number, were in fine shape for the season's work.

From there we worked north through range 19, and then returned to tp. 84-20-5, which was completed on October 20. In addition to the regular subdivision, levels were run along every alternate section line throughout the townships surveyed.

Through May and June the weather was very favourable for work, but through July heavy rains were experienced, which interfered somewhat with the progress of the work. By the time the work was completed on October 20, the weather was getting quite frosty and light snowfalls were experienced.

All of the townships subdivided are drained to the northwest by streams running into Peace river, except township 82, which drains to the southeast into North Heart river. Townships 86 and 87 are drained largely by Cadotte river which flows northwesterly into Peace river. Its bed is full of boulders and forms almost a continuous rapid from its mouth to range 19. Through this range and eastward, it is about a chain and a half wide; the rapids are less numerous and the current somewhat sluggish, meandering considerably in a more or less direct valley. Numerous beaver workings, some hay meadows, and a few small patches of spruce characterize this valley. The flats in the valley are mostly open, with an abundance of luxuriant grasses, peavine, and vetches.

In townships 83 and 84, there are several small shallow lakes which have no outlets, and there is considerable muskeg, although the levels show that there is plenty of fall for good drainage. The remainder of these townships and the other townships subdivided, especially townships 86 and 87, are covered with light bush, mostly poplar, with numerous sloughs, and open meadows covered with a heavy growth of grass. This land is quite suitable for agriculture.

During the season, several moose and bears, both brown and black, were seen. Foxes and coyotes were observed several times, and beaver and muskrat workings were seen in many places on Cadotte river. Ducks and geese were in great numbers on Runaway lake, in township 86, during August and September.

APPENDIX No. 37.

ABSTRACT OF THE REPORT OF W. J. JOHNSTON, D.L.S.

SURVEYS IN THE KAMLOOPS DISTRICT.

Having completed the organization of my party, I left Revelstoke on April 19, 1915, and proceeded to tp. 18-8-6, where my first work was located. This lay on the Mabel Lake wagon road about five miles east of Enderby.

The work in this township consisted of the survey of the north boundary and the subdivision of the northern tier of sections. The north boundary is crossed by Brash and Ashton creeks, which have narrow valleys about 2,000 feet below the level of the surrounding hills. A large portion of these sections is fairly good grazing land, covered with scattered fir and pine.

On completion of this work we moved to tp. 18-10-6, where the boundaries of a legal subdivision were surveyed.

On May 17, we commenced subdivision in tp. 19-10-6. This township has practically all been reserved for the protection of the water supply of the town of Salmon Arm. I was asked to investigate the land to ascertain its suitability for this purpose and I found that a large portion under reserve drained to the eastern slope, and could not be utilized. About sixteen miles of subdivision were run in this township.

Our next surveys were made in tps. 21 and 22-10-6. The work in these townships consisted almost entirely of cutting legal subdivisions and portions thereof out of timber limits. This was done in order to prevent settlers claiming ignorance of their boundaries, and encroaching on the limits.

Good wagon roads exist in all these townships, and I was able to use wagons, hired locally, for all camp moves, with the exception of one fly camp in township 20, range 9.

As a general rule the land is timbered with fir, pine, and cedar, with a thick underbrush, though in many places fires have passed through in recent years.

Rapid progress is being made by the settlers in improving their lands, and I think that eventually fruit growing will be the principal industry of the country.

On July 5, we moved by wagon across Shuswap lake on the Government ferry to tp. 23-11-6. This lake is one of the prettiest in British Columbia and may be rightly named "A sportsman's pardise." A fine Government wagon road runs easterly along the north shore, from the wharf near Scotch creek to a few miles beyond Celista in tp. 23-10-6. Another wagon road runs northwesterly from Celista up Meadow creek as far as sec. 23, tp. 23-11-6. The greater part of this township is mountainous, though some good bench land was surveyed along Scotch creek and in the southeasterly quarter of the township. Part of the boundary of Little Shuswap I.R. No. 4, was retraced.

A few miles of subdivision were also run in township 23, range 10. This township is rapidly becoming one of the best farming communities in British Columbia, not only for general farming but for fruit and berries as well.

Our next work was in tp. 22-12-6, where we were employed until September 10. Part of the boundary of Little Shuswap I.R. No. 1, was retraced and all the land lying north of the reserve was subdivided. Some good grazing land was surveyed, but the township is handicapped by lack of water.

The next work consisted of miscellaneous surveys in tp. 22-7-6, tp. 23-6-6, and tp. 23-4-6. This necessitated from two to three days' surveys in each township, and the work consisted principally of cutting small portions out of timber limits.

Malakwa, in township 23, range 6, is fast becoming noted for its celery. Last year's provincial reports classified the lands there as the finest celery lands in British Columbia. The soil is black, oily loam with a sandy subsoil. Vegetables are grown in abundance but this year there is no market for them.

On September 21, we moved to Revelstoke, and commenced surveys in tp. 23-2-6. This work consisted of surveying two sections into legal subdivisions.

Columbia valley is being settled very rapidly and great progress is being made in its development. A large number of Austrians, Hungarians and Italians are found among the settlers. This district is likely to become one of the greatest apple districts of the province. It has a cool climate which produces a firm and tasty apple. Practically all kinds of farming are carried on, and small fruits and vegetables are grown in abundance. It has been found that corn will grow well. A large portion of the valley is still held as timber limits, but portions of these, suitable for agriculture, are being withdrawn as rapidly as possible by the Dominion Lands Agent, and thrown open for settlement.

On September 29, we moved by wagon to tp. 24-1-6 where we spent the remainder of the season. This is practically a new township as far as settlement is concerned. Some very fine land lies along both sides of Illecillewaet river, though a portion of it is still held as timber limits. Owing to the presence of glaciers, frosts occur earlier than at Revelstoke, but grain growing and mixed farming can be carried on profitably. The valley does not exceed two miles in width, and has a gravelly subsoil.

Deer are fairly plentiful throughout the townships covered by our surveys and quite a number of bears were seen. Fishing is good early in the season in Shuswap lake and in the small creeks.

Practically no mining or prospecting is carried on.

The season was the wettest which I have experienced in the past four years. In July we had five days of steady rain, and May and June were also wet; as a result of this there were very few fires and what fires did occur were very small.

APPENDIX No. 38.

ABSTRACT OF THE REPORT OF R. H. KNIGHT, D.L.S.

SUBDIVISION SURVEYS IN NORTHERN ALBERTA.

The survey work done by me during the past season consisted of the subdivision of tps. 81, 82, 83, and 84-6-4, and tps. 84, 85, 86, 87, and 88-7-4, lying along the line of the Alberta and Great Waterways railway.

We left Athabaska on May 11 and, with twelve tons of supplies loaded on three scows, floated down the Athabaska to McMurray.

Our trip down the river was uneventful except for the usual difficulties encountered at the various rapids. We camped one night at the Pelican company's gas wells, a few miles below Pelican rapids. Three wells had been drilled at this point, and I was informed that their combined capacity was estimated at seven million feet per day.

Survey operations were commenced on May 21, at the junction of Christina and Clearwater rivers in tp. 88-7-4. The valleys of these rivers are about 500 feet deep, and the banks are rough and covered with timber from twelve to twenty-four inches in diameter, mostly poplar, with scattered patches of spruce. Clearwater river has an average width of about seven chains, and a current of about three miles an hour. The valley is about a mile wide with the river flats mostly on the south side of the river. The valley of Christina river is narrow with steep broken sides.

Besides these two rivers, four other streams were crossed by our survey lines during the season. Gregoire river drains Gregoire lake in townships 86, ranges 7 and 8, and Little Pembina, Meadow, and Kettle rivers rise in Little Rocky mountains and run easterly into Christina river. These streams average from forty to fifty feet wide, and abound with jackfish during the early part of the summer. The only lake of importance is Gregoire lake which is about ten miles long and four miles wide. The water is fresh and clear and contains an abundance of whitefish and jackfish.

While travelling along Clearwater and Athabaska rivers, in the vicinity of McMurray I noticed that both of these streams cut into the limestone formation which appears to have a dip about equal to the fall of the streams. From this it would appear that there is a decided depression in the limestone near the junction of these two streams. This is further borne out by the fact that Horse and Hangingstone rivers, both of which flow through the limestone formation, join the other rivers within a short distance of their junction.

The townsite of McMurray is located at the junction of Athabaska and Clearwater rivers, on a large level plateau about thirty feet above high water, and between the two streams. The population at the beginning of the survey numbered about 300 persons, mostly of Canadian birth.

The northern and southern portions of the district covered by my surveys are largely swamp or muskeg, covered with a thick growth of young spruce. The dense growth is apparently due to the fact that the muskegs are fairly dry. The central portion of the district is rougher and more rolling and is covered with heavier timber. Most of the high land in townships 83 and 84, range 6, has recently been overrun by fire, and the timber is nearly all fire-killed. The dead timber averages from eight to twelve inches in diameter. The soil on the ridges is mostly clay or sandy loam.

The only trail in this district, previous to the advent of the railway, was the Lac La Biche-McMurray pack-trail. The railway contractors cut out a wagon road following as closely as possible along the right of way of the new railway but this road could not be constructed through township 87 and the southerly four miles of township 88,

range 7, on account of muskegs and swamps. Consequently it follows the north side of Gregoire lake, and thence runs in a northwesterly direction, following approximately the old Lac La Biche pack-trail until within about eight miles of McMurray. It then strikes easterly and again joins the right of way in section 20, township 88, range 7. A wagon road has recently been opened through to McMurray along the old Lac La Biche pack-trail.

The season was, on the whole, dry, although four days of continuous rain was experienced in the early part of July. The first snow fell on September 11, and disappeared the following day. The first heavy frost was on the night of September 5, although light frosts occurred several times during the summer. Flurries of snow were frequent from September 11 until we ceased work, the heaviest occurring on October 30, when fully eight inches fell.

According to reports there is an abundance of small fur-bearing animals along the numerous streams. Coyotes and foxes seem to be plentiful. Moose is the most important of all game and is the only kind of fresh meat to be had in that country. The new railroad will open up one of the best moose-hunting grounds to be found in America. We closed operations on October 26 and returned to Edmonton reaching there on November 6.

APPENDIX No. 39.

ABSTRACT OF THE REPORT OF P. M. H. LEBLANC, D.L.S.

SUBDIVISION SURVEYS IN THE VICINITY OF FORT VERMILION.

Owing to the difficulty of access to the Fort Vermilion district, it was arranged that my party should remain in the field from the spring of 1914 till the autumn of 1915.

I left Edmonton on April 7, 1914, travelling by the Edmonton Dunvegan and British Columbia railway to Sawridge, and thence by teams to Peace River Crossing. From there we proceeded by scow to Fort Vermilion, reaching there on May 3.

My work in this district consisted of miscellaneous subdivision extending along the valley of Peace river from tp. 108-5-5 west as far as tp. 108-18-5, and also a portion of Wabiskaw valley in tp. 103-9-5 and tp. 104-10-5.

During the first part of the season the ground was frozen so hard that it was impossible to mound the lines run, and it had to be done later in the season. Also the mounding of the lines run late in the fall and winter had to be done after the spring thaw. This hindered the progress of the survey as it necessitated going over some of the lines twice. The traversing of Peace river and other large bodies of water was also left until the ice had formed.

We surveyed some Indian reserves and Hudson's Bay Company's reserves making the boundaries as far as possible coincide with the township subdivision lines.

We closed operations on September 29, and after making arrangements for wintering the outfit, left via Peace River Crossing for Edmonton, where we arrived on October 21.

The country passed over during the course of my surveys may be described as level, except where broken by the banks of the different rivers and creeks. It is generally covered with poplar up to twelve inches in diameter, willow, and spruce, but the latter is not in sufficient quantity to warrant its being reserved, though it will be found very desirable for settlers' use. A few patches of prairie, and large scrubby openings suitable for settlement were seen. On the slopes of Buffalo Head hills in tps. 101 and 102-10-5, areas of good spruce timber were seen. These areas are close to Wabiskaw river and the timber could be easily floated down that stream to Peace river. The tops of Buffalo Head hills are covered with poplar, spruce, birch, and jack pine, partly fire killed.

The soil of the district consists generally of black loam with clay or sandy clay subsoil, and is very suitable for mixed farming.

Good hay land is found in tp. 104-14-5 and numerous hay marshes and meadows of different sizes were also noticed in several other townships, principally tp. 108-17-5, the northern part of tp. 108-16-5, and tp. 108-11-5. Fresh surface water is found in different lakes and marshes as well as in the creeks and rivers, but in the rivers, especially in Peace river, the water is generally muddy in summer. Alkaline water is also found in different lakes and sloughs.

Besides Peace river the largest streams noticed were Wabiskaw, Mikkwa, and Boyer rivers. All these streams are tributaries of Peace river; they rise very high with the summer rains. The sides of the valleys, though steep, are broken by numerous ravines which afford easy slopes to the river flats.

Peace river varies in width from one-half to one and one-half miles, with a depth of about thirty feet and a current averaging two and one-half miles an hour; it still affords the easiest and most direct route to reach Fort Vermilion district. Settlers starting from Edmonton can travel via the Edmonton Dunvegan and British Columbia railway to Peace river Crossing and from there may board any of the numerous

steam or gasolene boats which are now plying from the Crossing to all points between Hudson Hope and Vermilion chutes, or if preferred they can build rafts or scows upon which to load their implements, furniture and supplies and float down the stream to their destination. Fort Vermilion can be reached in this way in about a week. The river is usually open by May 1.

Good wagon roads lead from Fort Vermilion or North Vermilion to all the townships surveyed which are not reached directly by the river. I am informed that the Alberta Government intends to continue the opening of the wagon road from North Vermilion to Peace River Crossing, which is already cut as far as Keg river.

During the two summers spent in that country, I observed that the climate was very dry and warm, though the nights were cool, but no frost was noticed between June 15 and September 1. One occurred on June 15, 1915.

The intervening winter was cold, which is characteristic of that high latitude, but the atmosphere is so dry that the party did not lose one complete day's work on account of cold or stormy weather.

The average depth of the snow for that winter did not exceed twenty-four inches, which however is considered more than usual; it was all gone by April 15. Seeding was started about May 1, and the crops were ripe and harvested in good condition by the end of August.

Trapping is still the main occupation of the settlers, and is the principal trade of the country, though the farming business has been gradually increasing every year until the European war put a stop to immigration. At the close of the war however, the Fort Vermilion district is bound to boom owing to the quality of the land and the advantage it offers to intending settlers, who would find a local market for their produce, as it is one of the most northerly points where supplies may be procured by travellers, trappers, and Indians, inhabiting the northern wilderness.

In view of the future development of the country, many boats are now in readiness for service on Peace river, and a new company has also decided to increase that service by adding a large boat, which was under construction at Peace River Crossing when I left last fall, so the prospects are that a more frequent and regular service will be inaugurated on that river.

With the exception of Vermilion chutes, where immense power could be developed, no water-power sites were noticed. No minerals, coal, or stone-quarries were seen except deposits of limestone at the mouth of Mikkwa river in tp. 108-5-5. At Vermilion chutes, a company has started boring for oil, and when they temporarily stopped drilling last fall at the depth of 280 feet they claimed the prospects of success were very good.

A few oil claims have also been staked by other companies in the neighbourhood of the chutes, and if their expectations are realized, the intention is to build a railway at once from Athabaska via Wabiskaw lake to Fort Vermilion. Preliminary surveys have already been made with that end in view. Large game and fur-bearing animals are still plentiful in Buffalo Head hills, but scarce near the settlement. Usually the hunters have to go a long distance for their trapping.

A Board of Trade has been organized at Fort Vermilion, composed of the most influential residents of the community, with the object of aiding in the development of the district.

Protestant and Roman Catholic schools and churches are located at Fort Vermilion and at Stony Point, which is about seven miles from the former place.

Judging from the climatic conditions in Fort Vermilion district, as I observed them, and from information I gathered from pioneer settlers, I venture to say that outside of the immediate vicinity of the river valley safe crops of all kinds of cereals cannot yearly be expected until the country is entirely opened and cultivated. This would allow the heat of the sun to penetrate the ground, which now remains frozen until late in summer, on account of being mostly covered with bush and scrub. Mixed farming, however, will always be safe.

APPENDIX No. 40.

ABSTRACT OF THE REPORT OF A. LIGHTHALL, D.L.S.

SUBDIVISION SURVEYS NORTHWEST OF EDMONTON.

My instructions for the season of 1915 were to subdivide townships 61 and 62, range 8, townships 63, 64, and 65, range 7, and township 65, range 6, all west of the Fifth meridian. These townships lie in a block about one hundred miles northwest of Edmonton, and just north of Athabaska river.

After making a preliminary trip into this district, I decided that horses and wagons would be the best means of transportation. I accordingly started the wagons and horses from Edmonton a couple of days ahead of the party, which left Edmonton by rail and met the wagons at Westlock, in tp. 60-26-4, on May 25. From there the remainder of the trip was made on foot. The country is fairly well settled right up to where our survey began, but at the time we went in, the summer rains had just started and the roads were in very bad condition. However the Provincial Government had considerable work done on this road during the summer, and when we came out in the fall it was in fine condition. The settlers have been in this district four or five years and already have made great progress. It is a country suited for mixed farming rather than for grain growing, and more than enough beef, pork, butter, and eggs are produced to supply local needs.

We crossed Athabaska river on the ferry at Holmes Crossing and followed the wagon road on to Freeman River post office. From that point we had to cut our own road to the 17th base line, a distance of about fifteen miles; this work occupied five days. It is comparatively easy to make a wagon road on high land, but crossing the numerous muskegs is a slow, tedious proceeding. A thick mattress of brush is laid down to prevent the horses and wagons from sinking; this is known as a brush road as distinguished from corduroy, which is more permanent and is composed of larger timber.

The survey was started on June 7, in tp. 65-7-5, and was carried easterly into tp. 65-6-5. The old Klondike trail from Edmonton to Dawson passes through the latter township. This is a wagon road, and it is in a fairly good state of preservation. It is still used by an occasional Indian or half-breed travelling to the Lesser Slave lake region. Some very good grass land is found along Timeu creek which flows southeasterly through these two townships.

After the completion of these townships we carried our surveys southerly towards Athabaska river. Along Freemen river which flows southeasterly through tp. 63-7-5, the timber is lighter and there are some fine stretches of grass land which is very suitable for cattle raising. Township 61-8-5, the most southerly of the group, is within a short distance of Athabaska river and the land is more rolling and hilly than farther north. A lake about two miles long and half a mile wide, known locally as Goose lake occupies the northern part of this township. Although there are numerous lakes in this district, this is one of the few that has any considerable depth of water, thirty feet being found over a large part of it. Considerable quantities of jackfish are taken from it in winter and shipped to Edmonton.

The climate in general is rather moist over this section of country. A long dry spell occurs in the spring, but from June until August, rain is plentiful. In the fall the weather is usually very fine, being clear, cool, and dry, and the winter is not very severe. Summer frosts occurred last season until the first of July, but this did not

seem to affect the growth of grain or vegetables. Potatoes which were frozen down flat on July 1, were up again and in full blossom by the middle of August, and were a splendid crop when dug in the fall. Grass is abundant and of fine quality in the summer, and cattle and horses running at large get very fat. The Indians leave their stock out all winter without any shelter and without putting up any feed for them, and although this works fairly well with their animals it is not a practice to be recommended for ordinary farm stock.

The survey was completed on November 15, and on the 23rd, we reached Edmonton where the party was discharged.

APPENDIX No. 41.

ABSTRACT OF THE REPORT OF G. J. LONERGAN, D.L.S.

INSPECTION SURVEYS IN THE PEACE RIVER DISTRICT.

I left Ottawa on April 8, 1915, for Calgary, where I joined Mr. C. F. Miles, D.L.S., and with him proceeded to Edmonton to appraise the outfits of a number of surveyors who had been employed under contract in 1914. This was necessary as the department had decided to abandon the contract system, and had consented to purchase the outfits. As the outfits were located in different parts of the country, this necessitated much travelling, and took considerable time.

I left Edmonton on May 30 for my next work, the survey of timber berth No. 2210, near McGillivray in British Columbia. The surface of this district is extremely rough, and is thickly covered with large timber. The Riverside Lumber Co. have a saw-mill about five miles south of McGillivray, and not far from the timber berth. This was one of the few saw-mills in British Columbia that was in operation last summer, giving employment to about four hundred men. The timber on this berth is chiefly spruce and fir up to about twenty-four inches in diameter with a few pine and larch. The estimated amount of lumber is between two and a half and three million feet.

After completing this survey I returned to Edmonton, whence I left for Peace River Crossing to inspect a number of contract surveys in the Peace River district, commencing with Mr. R. V. Heathcott's survey northwest of Bear lake. The townships in this contract were at one time covered by a spruce forest, but repeated fires have destroyed the timber and burned up the windfall, and the ground is now covered by a second growth of small poplar and willow scrub. The soil is good, chiefly a clay loam, and as the land will be easily cleared, there is no doubt it will soon be taken by settlers. As the horses contracted swamp fever here, I decided that is was not prudent to continue working them, and thought if they were given a few weeks rest on high dry ground they might recover. I therefore returned to Peace River Crossing and left them in charge of one of the men.

I rented two row-boats and started down the river sixty-five miles to Mr. J. A. Buchanan's survey, which we inspected.

I then returned to Peace River Crossing and started for Spirit River to inspect Mr. Tipper's survey.

After completing the inspection of Mr. Tipper's survey we moved northwest of Vanrena to inspect the surveys of Messrs. H. S. Day and T. A. Davies. I left my assistant in charge of this work while I went to Peace River Crossing to make arrangements for the wintering of the Government horses in that vicinity. I then returned to my party and completed the inspection in that district.

There is a large tract of exceedingly good country extending from Island lake in tp. 83-4-6, westerly along the north side of Peace river to Fort St. John. It might be described as fifty per cent prairie and the remainder covered with light poplar and willow scrub. The ground is covered with a luxuriant growth of upland hay and peavine. There is an abundant supply of water in the numerous creeks and small lakes, and the soil is a loamy clay.

On the completion of this work it was decided to leave at once for the Peace River block to inspect the surveys of Messrs. S. D. Fawcett and L. Brenot. As the wagon road on the north side of the river was in very poor shape, and as the trail from Spirit River settlement was only fit for winter travel, it was decided to drive around by Saskatoon Lake and thence up the fertile valley of Beaverlodge river to

the southeast corner of Pouce Coupe settlement. From there we followed the telegraph line to the south side of Peace river opposite Fort. St. John. There was no ferry at this point, and being advised not to attempt to swim the horses as I might be caught across the river with running ice, I hired a few horses on the opposite side of the river, and with a blanket for each man and some provisions, we started for Mr. Brenot's work, which was scattered along the north side of Peace river from Fort St. John westward.

This district is a continuation of the country west of Island lake, previously mentioned, and is reported to be ninety by forty miles in extent. It is covered by light scrub with many open places. The surface soil is sandy loam with a clay subsoil, and it appeared to me to be one of the best grazing countries I ever visited; the vetches and peavine make travelling very difficult. As is usual in a new country it was reported that the water question was a serious matter, the rivers, lakes, and creeks being the only supply, but there are very few settlers, and no person has yet attempted to dig a well. Fort St. John is a thriving village situated on the north bank of Peace river. It has steamboat connections during the summer, a telegraph office, and a semi-weekly mail service. It is reached on the north side of the river by pack-trails, and on the south side by a wagon road from Pouce Coupe settlement. This road follows high dry ground, the only difficulties being the crossing of Kiskatinaw and South Pine rivers and the steep banks on either side; both rivers can be forded during September and October.

On my return trip I inspected Mr. Fawcett's survey. It consisted of the subdivision of the country through which Kiskatinaw river flows. The country to the north was at one time an immense spruce forest, but it has been burned over and is now covered with light scrub. The soil is clay and the surface soil, which consisted chiefly of vegetable matter, has been mostly burned off. A better soil was found in the southern parts of townships 77, 78 and 79, and the scrub was somewhat larger with many open places. It was reported to me that west of these townships there is some very fertile land with large prairie openings. During the fall of 1913, when I was in the Pouce Coupe settlement, there was but one settler who had a few cattle and depended on trapping for a living. Last fall two threshing outfits moved up from Grand Prairie to do the threshing for the Pouce Coupe settlers. They estimated a harvest of 175,000 bushels of grain. This I believe is a record equal to anything in the world for a new country.

My last inspection of the season was that of Mr. J. H. Johnston's survey in tps. 82, 83, 84, 85, and 87-19-5. These townships are heavily timbered with poplar up to fourteen inches in diameter and some small scattered bunches of good milling spruce. Unfortunately the milling timber is not found in sufficient quantities to pay to build a large mill, but there are good openings for small portable mills, with a ready market for lumber at Peace River Crossing.

I next moved my camp to tp. 81-21-5 to do some miscellaneous surveys. To reach this place I followed the Grouard and Peace River trail twenty miles south from Peace River Crossing, and then west to North Heart river. I was surprised to find so few settlers on such good land. The apparent explanation is that people start out for Peace river and will look at nothing on this side of it. In tp. 81-20-5, I drove through some beautiful country. The land is easily cleared, there is plenty of water, and it is close to a railway and market, but there were no settlers.

On completion of this survey I closed operations and returned home, where I arrived on November 27.

APPENDIX No. 42.

ABSTRACT OF THE REPORT OF E. S. MARTINDALE, D.L.S.

STADIA SURVEYS IN THE LLOYDMINSTER DISTRICT.

Owing to the illness of Mr. G. W. Coltham, D.L.S., I took over his party on August 2 and continued the surveys until the end of the season.

The work upon which the party was engaged was the investigation and stadia traverse, where necessary, of all water areas in certain townships in northeastern Alberta. In isolated cases also where a corner could not be established in the original survey on account of a water area, and the body of water had since dried up we were required to mark the corner by a proper monument. Where more than two or three of these cases occurred in a locality the work of establishing the corners was left to be done later by a regularly organized party.

Magnetic observations were also taken in every township where it was possible to do so without interfering with the regular work of the survey.

On August 3 camp was moved to tp. 44-1-4 and investigations on the summer or prairie division of our instructions were continued. Twenty-two townships including township 44, range 1, townships 45 ranges 1, 2, 3, and 4, townships 46 and 47 ranges 1 to 8 inclusive and township 48 range 10, comprised the remainder of this portion of the work assigned to the party and was completed by September 15.

In this block the lakes were not numerous, being mostly shallow and in nearly every case fed only by surface water. Generally speaking they are gradually drying up and in fact most of the sloughs and small ponds noted in the original survey are already completely dry. The water in the majority of the lakes is more or less strongly alkaline.

The area investigated is but sparsely settled except in a few townships; however, as most of the land is patented it would appear that much of it is being held by speculators. The methods of mixed farming are being successfully followed and the settlers appear to be fairly prosperous. Crops this season were excellent.

Battle river, a stream from two to three chains in width, follows a very tortuous course through a narrow valley from two to three hundred feet in depth through the block and marks a sharp dividing line as to markets for the settlers, those north of the river depending on the villages and towns along the Canadian Northern railway while those to the south are served by the Grand Trunk Pacific. Fine steel bridges are maintained by the province in township 45 range 3, township 46 range 6, and township 45 range 7, but the long grades on both sides of the river make heavy haulage across the valley difficult and expensive. The river was not traversed as the scrub and brush along the banks made a survey impracticable until after freeze-up. Several of the municipalities are taking up the question of improved highways and in some townships are many miles of good graded roads. The Government rural telephones also extend over part of this block and are proving a great convenience to the settlers.

Completing the summer work we next went north, crossing the Canadian Northern railway at Mannville and commenced investigations in the autumn or wooded portion of our work. Township 53, range 8, township 54 range 7, township 55 range 8, townships 57 ranges 9 and 10 and part of township 60 range 11 were completed in the order named before closing operations for the season. Edmonton was reached on November 23 and the party paid off.

Lakes are numerous, the largest in the district being Upper and Lower Therein lakes each of which has an area of approximately six square miles. These lakes

were shown on the old plan as joined but are now separated. The later has a depth of eighty-five feet near its westerly shore, this being the greatest depth noted during the season. These lakes have neither inlet nor outlet but it is supposed by the settlers that the latter is supplied by springs in its bottom as they state that they are never sure of the ice on this lake even in the coldest winter.

The settlers in this vicinity are mostly of French descent.

Fish are found in very few of the lakes investigated during the summer, the notable exceptions being St. Cyr lake in township 57 range 9, and Lower Mann lake in township 60 range 11 both of which are reported to be well stocked with pike and pickerel.

The weather from the beginning of August was exceptionally fine with practically no rain and plenty of sunshine to ripen the grain. A frost was noted in the bottoms on August 23, but it apparently did little damage. The first binder in operation was noted on August 18, and practically no time was lost throughout harvest or threshing on account of adverse weather conditions.

Prairie-chickens, ducks and partridges were fairly numerous while several flocks of wild geese, pelican and sandhill cranes were seen.

APPENDIX No. 43

ABSTRACT OF THE REPORT OF D. F. McEWEN, D.L.S.

SUBDIVISION SURVEYS SOUTHWEST OF LESSER SLAVE LAKE.

My work for the season of 1915 consisted of the subdivision of townships 72, ranges 15, 16, 17, and those portions of township 72, range 13, and townships 71, ranges 14, 15, 16, and 17 lying north of the northerly limit of the proposed addition to Lesser Slave Forest reserve, all west of the Fifth meridian.

I left Grouard on April 13 to make a reconnaissance trip through the district to be surveyed, to ascertain the condition of the trails. I then proceeded to Edmonton where I obtained my supplies and outfit, and returned north over the Edmonton Dunvegan and British Columbia railway, to High Prairie where the party was organized.

On May 12 we proceeded south over a very good wagon road which follows the right bank of West Prairie river for some distance, and then branches southeasterly to the E. by sec. 24, tp. 72-17-5, where our first camp was established. As this was the end of the wagon road it was decided to make it our main supply camp for the season. A considerable quantity of supplies was therefore freighted in and cached, and a pack-train was used for transportation throughout the work.

Subdivision was commenced in range 17, and from there we worked easterly to tp. 72-13-5, which was completed about the beginning of November. The party was then all paid off with the exception of those required for traversing. The traverse of Driftpile river and those portions of East and West Prairie rivers, which it had been found impracticable to do earlier, was completed on December 9. We arrived back at High Prairie on the 12th.

During the latter part of July, and throughout August and September, the work was greatly retarded by wasps, which were so numerous as to become a veritable plague. The nests were everywhere on the ground, and they not only caused annoyance and delay on the line, but made the work of the packers a very arduous and unpleasant task. The horses often became unmanageable, and, refusing to follow the trail, would scatter through the bush on the run, loosening and tearing off their packs: several packs were completely lost in stampedes. The canvas boat supplied by the Department was lost in this way, and could not be found.

The western portion of the district is drained by West Prairie river, which flows through township 71, range 16, and townships 72, ranges 16 and 17. Through the northern part of township 72 it has an irregular valley about half a mile wide, with steep banks about eighty feet high. In this valley it has cut a narrow channel from ten to twenty feet deep. It is about eighty feet wide and two or three feet deep, with a current of one mile per hour, and is broken by numerous small rapids. Owing to its confinement in this narrow channel, it rises rapidly during flood to as much as eight or nine feet above its normal level. Farther up stream the valley gradually disappears and above Carrot creek, which enters in sec. 10, tp. 72-17-5, the river narrows down to about forty feet.

East Prairie river flows through township 72, range 15, and townships 71, ranges 15 and 14. It has no well-defined valley through these townships, the land gradually rising from the river to the divide on each side. It has an average width of about 100 feet, a depth of one and one-half feet, and a current of about one mile per hour. It has cut a channel from ten to twenty feet deep, with almost perpendicular banks in

which it is confined, causing the water to frequently rise six or eight feet after heavy rains, but no land is flooded. It is extremely crooked, and numerous portions of ancient beds are to be seen in close proximity to the present one. The land in the vicinity of this river is most easily reached over pack-trails leading from the station of Arcadia on the Edmonton Dunvegan and British Columbia railway. One leads south through tp. 72-15-5, on the east side of the river; another leads southwest from the same station crossing the river in sec. 5, tp. 73-15-5, and enters tp. 72-15-5, on the west side. Various branch trails lead from these to every part of the district. A pack-trail from Prairie River settlement to Snipe lake crosses the 19th base line about the middle of sec. 33, tp. 72-16-5.

Driftpile river flows through secs. 24, 25, and 26, tp. 72-13-5. It has a valley from one-half to one mile wide with well-defined steep banks, from 130 to 180 feet high. It has an average width of about seventy feet, a depth of about two feet, and a current of about one mile per hour. The country in this vicinity is best reached by the old Klondike wagon road which leads from Arcadia station.

Generally speaking, the above streams are bordered on each side by a strip of alder swamp or spruce muskeg, from a quarter to one and one-half miles wide, and distant one-half to one and one-half miles from the river. The soil in these muskegs is good, and as a rule they are shallow and could be easily drained.

The soil in the river valleys consists of from eight to twelve inches of black loam overlying a clay or sandy clay subsoil, and produces an abundant growth of hay and other vegetation wherever openings occur. At intervals along each of these rivers are to be found prairie openings of small extent, also lightly timbered areas, covered with willow and small poplar, which are easily cleared. This will be of great advantage to the incoming settler.

The higher land is mostly level or gently rolling, and is covered by a heavy growth of timber, principally white poplar and balm of Gilead from six to fourteen inches in diameter, together with scattered spruce from ten to twenty-four inches in diameter. Considerable birch also grows in the eastern part.

The soil is good, consisting principally of black loam from four to twelve inches deep on a clay subsoil, which together with the abundant moisture through June and July, produces a luxuriant growth of vegetation of every description. The whole district is well suited for mixed farming.

Drift coal of good quality was seen on the bars in all the rivers, but no veins were observed. No mineral or rock in place was seen. There are a few moose and bears in the district. One of the latter got into one of our caches and destroyed a considerable quantity of suppiles. Signs of beaver were seen, while foxes, lynx and mink are plentiful.

APPENDIX No. 44.

ABSTRACT OF THE REPORT OF P. J. McGARRY, D.L.S.

SURVEYS IN THE NEW WESTMINSTER DISTRICT.

I left Hope with my party on April 22, 1915, and proceeded to Merritt; from there we went by construction train on the Kettle Valley railway to Coquihalla summit in sec. 13, tp. 8-23-6.

Our work in this district consisted of the survey of section lines along Kettle Valley railway in townships 8 and 9, range 22, townships 7, 8, 9, and 10, range 23, and townships 6 and 7, range 24, all west of the Sixth meridian. This branch of the Kettle Valley railway which runs southwesterly from Brodie junction to Hope crosses the Coquihalla summit at an elevation of 3,660 feet and has a maximum grade of two and one-fifth per cent. The line is about forty-five miles long and is rapidly nearing completion. When it is finally in operation this district will have excellent transportation facilities. Before the constructon of the railway the district was reached by a fairly good wagon road from Merritt. This road is at the present time in very bad shape and completely destroyed at many points where it intersects the railway line, but it could with little expense be put in good condition again.

Along Coquihalla river in tps. 7 and 8-23-6, there is little or no bottom land. The banks are mostly steep and rocky, with little soil and numerous cliffs. At the southern end of Coquihalla lake the valley increases in width to about fifteen chains and continues over the Coquihalla summit to Coldwater river at the same average width. At the headwaters of Coldwater river in secs. 9, 10, 14, 15, and 16, tp. 8-23-6, there is a flat twenty chains in width. It is at the present time flooded on account of beaver dams, and the river flat from there north would not average more than ten chains in width. There are, however, some good bench lands in secs. 23, and 26, tp. 8-23-6, and secs. 11, 14, and 23, tp. 9-23-6. The soil in these areas is good and varies from a sandy loam to a light clay loam. There are some excellent grazing lands on the east side of Coldwater river near the south end of tp. 9-23-6, and also in the Murray lake district in tp. 10-23-6, but little merchantable timber is found in this district. Sections 33, 34, and 35, the only ones surveyed in township 7-23-6, are almost completely burned over. In tp. 8-23-6 there is an area surrounding Coquihalla lake and covering about five square miles on which the timber has not been destroyed by fire. It consists chiefly of balsam, spruce, and hemlock with a few areas containing some good white pine to thirty inches. In sections 23 and 26 there is also a thick growth of spruce, balsam, and hemlock. Secs. 1, 2, 11, and 12, tp. 9-23-6 are completely burned over, but the remainder of the township along Coldwater river is thickly timbered with balsam, hemlock, fir, pine, and spruce to twenty-four inches. In sections 1, 2, 11, and 12 of tp. 10-23-6, are found some small jack pine balsam and poplar.

Good drinking water and wood for domestic use may be found almost everywhere.

Although the winter was unusually mild the snow in the valley was still over a foot deep when the party arrived at the work on April 24. It was fast melting however, and in a few days had entirely disappeared. According to old residents in the district it is not unusual to have cold weather and snow up to the beginning of June, with winter setting in about the end of October. No summer frosts were noticed although they are said to be not unusual.

No water-powers suitable for development were noticed, and, although a considerable amount of prospecting has been done and some claims staked, there does not appear to be any mineral of commercial value in the district.

In Coquihalla lake the trout are small but exceedingly numerous, and fishing is not very good in the rivers and small mountain streams. There are plenty of deer to the east of Coldwater river near the northern boundary of tp. 8-23-6. A few goats were seen but bears are very scarce.

The few settlers located in the southern part of tp. 9-23-6 consider the country better adapted for grazing than anything else. The short growing season and the likelihood of summer frosts makes it very unsuitable for agricultural pursuits.

After the completion of the work in the Hope district on July 29, we moved to Chilliwack and from there up Chilliwack river to the end of Mt. Baker wagon road, in section 34, tp. 1-29-6. This road is now being extended as far as the mouth of Slesse creek in sec. 32, tp. 1-28-6. There is a trail up the north side of the river as far as Chilliwack lake and on the south side from Slesse creek to Middle creek, and along Middle creek to the international boundary. The trail along Middle creek is very rarely used and is in many places, extremely difficult to follow.

Our work in this district consisted of the survey of lands along Chilliwack river through townships 1, ranges 27, 28, and 29 and townships 2, ranges 27 and 28. This was completed on October 15 after which the party returned to Chilliwack and was disbanded.

There are a number of small areas in tp. 1-29-6 and tp. 1-28-6, which are suitable for agricultural purposes. On the benches the soil is usually a light clay loam with clay subsoil, but in many of the river flats it is of a loose sandy or gravelly nature. In secs 1, 2 and 3, tp. 2-28-6, there is a large level bench which should make good agricultural land. In tp. 2-27-6 the flat along the river averages about twenty chains in width, and contains some patches of excellent soil particularly near the foot of the hills, but is heavily timbered. No good agricultural lands were found along Ford or Middle creeks and there is no good grazing lands anywhere in the district.

Timber is the main resource of the district, and it grows almost entirely on the south side of the river. The timber to the north, with the exception of a few odd patches, has been completely destroyed by fire. There is some excellent fir and cedar in secs. 27 and 28, tp. 1-29-6, many trees being as large as eight feet in diameter. Practically all the good timber and many areas that have no timber value have been included in timber berths. No logging operations have yet been carried on. Some shingle-bolts are being cut on the area just west of the commencement of the work.

No traces of valuable minerals were found in the area examined, but mines, producing gold in paying quantities, are being worked near Slesse creek, at the international boundary.

The climate is practically the same as that prevailing throughout the lower Fraser valley. It is usually mild with an abundance of rain.

Trout abound in Chilliwack river and its tributaries and the fishing is unrivalled. During the season many fishing parties visited the district and there is little doubt that when the attractions of the locality become better known the number of such parties will greatly increase while the number of trout will correspondingly diminish. Game does not seem to be very plentiful, as only a few bears, goats, and deer were seen.

Practically all garden products can be grown in this district and fruit ripens well. The few settlers in the valley seem to be very prosperous and no doubt all the available land will soon be settled.

APPENDIX No. 45.

ABSTRACT OF THE REPORT OF R. B. McKAY, D.L.S.

OBSERVATIONS FOR LATITUDE IN MANITOBA AND SASKATCHEWAN.

The first observation for latitude was taken on the Third meridian in township 68. As this point could be most easily reached with sleighs, I left Prince Albert on March 5. Montreal lake which was crossed on the ice was reached two days later, and from there we followed an old sleigh road cut out by some surveyors. This trail ended at section 13 in township 68, and as the locality was favourable for an observation and the supply of horse feed was getting low, I decided to make the observation on the Third meridian near the northeast corner of section 12, while the teamster returned to Prince Albert for a wagon and horse feed for my return trip. On March 29 the teamster returned and as I had completed my observation, we commenced our return journey the following morning. There was then very little snow in the bush, but the muskegs and streams were still frozen, and we were able to use the sleigh until we reached the south end of Montreal lake, where we transferred our outfit to the wagon and proceeded along the summer road to Prince Albert which we reached on April 7.

The country in the vicinity of our work consists of spruce and tamarack swamps interspersed with sandy ridges timbered with jack pine, and is unsuitable for agriculture.

No further work was done by me until about the middle of June when I received instructions for further observations. I then proceeded to Selkirk, Man., and taking an assistant with me, we travelled by wagon to the NE. cor. of tp. 16-7-E. which we reached on June 24. After experiencing considerable rainy weather, the observation at this point was completed and we returned to Selkirk on July 8.

The next observation was on the 10th base line at its intersection with the west shore of lake Winnipeg. While in that locality a number of cariboo and moose were seen, also a number of wild geese and ducks.

We completed this observation on July 25, and moved by sailboat to my next objective point on the 8th base line, on the west shore of lake Winnipeg, which we reached on July 28.

After completing the observation on the 8th base, we sailed to Hole Indian reserve, where arrangements were made to have the outfit packed to the NE. cor. tp. 25-9-E. We reached the place of observation on August 11, but owing to the smoke and cloudy weather I was unable to start observing until five days later. We were then favoured with four good nights, and completed the observation, after which we returned to the reserve, and thence moved by sailboat to Hecla island, where we caught the steamer "Wolverine" and reached Selkirk on August 23.

The next observation was at the intersection of the Principal meridian with the Hudson Bay railway. To reach there we proceeded to Pas, and from there we travelled to the end of steel on the Hudson Bay railway. The Principal meridian crosses the railway a short distance westerly from mileage post 197. The country in this vicinity is rolling and timbered with small spruce, tamarack, and jack pine, the most of which has been fire-killed. The soil is clay and clay loam. Considerable prospecting has been done in the district traversed by this railway and several gold finds have been reported.

We next moved to the 16th base line, near its intersection with the Hudson Bay railway which was the next point of observation. This was completed on October 2 after which we returned to Pas. I then observed for latitude at the intersection of the 9th base line with the Second, Third and Fourth meridians respectively, completing the latter observation on November 4. As this completed my season's work, I shipped the zenith outfit to Ottawa and proceeded to my home in Vancouver, where I arrived on November 7.

APPENDIX No. 46.

ABSTRACT OF THE REPORT OF J. H. McKNIGHT, D.L.S.

STADIA SURVEYS IN WADENA DISTRICT.

The party was organized at Prince Albert and on May 29, 1916, we reached tp. 33-12-2, where we began work.

The lakes in this district are all shallow and strongly alkaline, with the exception of Fishing lake, which contains clear fresh water and averages about twelve feet in depth. Pike and pickerel are caught in large numbers by the settlers, and by Indians from the reserve adjoining the lake to the west. On the north shore there is a summer resort and an excellent sand beach for bathing. The farmers are successfully following ranching and mixed farming and have a rural telephone system connecting with Wadena, a town on the Canadaian Northern railway of about six hundred population.

Several of these small alkaline lakes could be easily drained, as the average depth is less than nine feet. Ponass lake, the largest body of water in the district, covers about seventeen square miles. The shore line is very irregular being a series of narrow points from one to three miles in length. The water is alkaline and the average depth is five feet. There are no creeks entering the lake and the outlet has been deepened and enlarged by the settlers, and at the time of survey the estimated discharge was forty cubic feet per second. This has lowered the water level nearly two feet. Abundance of excellent hay grows around the lake and on the larger islands; hundreds of tons are cut each year. The soil in this district is a good clay loam, but there is considerable bush to be cut and cleared before the land can be cultivated. The settlers are nearly all Norwegians or Galicians, who go in for mixed farming and cattle raising. Although only a newly-settled district, several of the settlers have from sixty to one hundred head of cattle.

Many of the other lakes have dried up to such an extent that large areas of the dry beds are under hay. Mixed farming is extensively followed and appears to be the industry best suited to the district.

I closed operations on November 18, and discharged the party.

APPENDIX No. 47.

ABSTRACT OF THE REPORT OF W. A. A. McMASTER, D.L.S.

RESURVEY OF PRINCE ALBERT SETTLEMENT.

We began the resurvey of Prince Albert settlement on August 25, 1915, by retracing the rear line, where we had discontinued operations the previous season. We then went to the base line, and in retracing it found only one monument within the city limits. After entering the city the base line runs along Fifteenth street to the line between river lots Nos. 70 and 71 and there it is deflected to the north. It was impossible to rerun the base line from the east side of river lot 72, so we made a traverse from this point to the east side of river lot 82.

As nearly all the monuments on the base line fell on streets or avenues, we left the base line and started to retrace the boundaries of the Hudson's Bay reserve.

On finishing this work we returned to the base line and put in iron posts where they did not fall on streets or avenues, and where they did we connected them to the street corners. This was very difficult as a great many of these corners, having been put in from thirty to forty years ago, were very hard to find.

Having completed the work in the field on October 7, I discharged the party on the following day.

APPENDIX No. 48.

ABSTRACT OF THE REPORT OF A. M. NARRAWAY, D.L.S.

MISCELLANEOUS SURVEYS IN SOUTHERN ALBERTA AND SASKATCHEWAN.

My first work consisted of an examination of the 3rd correction line across ranges 10 and 11, west of the Fourth meridian, for duplicate monuments. This work was done before my regular party was organized.

Organization was completed at Maple Creek on April 24, and our main camp was kept there while we resurveyed tp. 11-25-3. This work was completed on May 12.

On May 17, we commenced the resurvey of tps. 13 and 14-29-3. Both of these townships are rolling prairie with numerous drifting sand-hills. On this account many monuments were missing, and permanent ones were difficult to establish. Good progress is being made by the settlers, who were helped by the heavy rains during the first week in June. Considerable horse and sheep ranching is being carried on in these townships.

We left this district on June 10, and commenced the resurvey of tp. 13-26-3, on the 11th. This township is gently rolling prairie, and contains plenty of good water and feed for ranching purposes. Maple creek, a stream about fifty feet wide and ten feet deep, passes through the township, running north from springs in Cypress hills; it contains good water.

Our next work was the retracement of the correction line along the north boundary of tp. 10-26-3, together with the closings thereon. This work ws commenced on June 23 and finished on the 28th.

From there we moved to tp. 9-20-3 and commenced the resurvey of this township on July 1, finishing on the 16th. It is situated on the top of Cypress hills, and on account of its roughness is used largely for ranching purposes. There is excellent spring water throughout the township. Swift Current creek, which flows through the township, is a very crooked stream, about nine feet wide and four or five feet deep.

The retracement of tp. 13-23-3, was commenced on July 19. More than half of this township is taken up by Crane lake, which in many places is over twenty feet deep. The great sand-hills run right to the edge of the lake on the east and north, with the result that very few monuments in these districts can be found. Section 7 of this township is devoted to farming and this season some good crops were harvested. The remainder of the township is used for ranching purposes. Some large flocks of sheep, as well as cattle and horses, were seen in this district. Crane lake it noted throughout southern Saskatchewan for its game. In the fall large flocks of geese and ducks congregate on it,and hunters find it an ideal shooting place. The Canadian Pacific railway passes within one mile of the township, and shipping to the market is thus convenient.

We next proceeded to tp. 16-22-3, and commenced its retracement on August 10. This township lies partly in the great sand-hills, which is a large range of hills composed of sand, and largely covered by willow, cherry, and buckthorn brush. In places large bare sand stretches were seen, where the drifting sand had covered trees fifteen feet high. Many monuments were missing throughout this township. In the southeastern portion the settlers have made good progress, but even there the soil is light and requires a lot of moisture to produce a crop. This year, being exceptionally wet, the grain fields were good and the yields high. A large part of the township is devoted to ranching.

Our next work was the resurvey of tps. 22 and 23-19-3. This was commenced on August 28, and completed on September 23. Both of these townships proved to be exceedingly difficult to survey. Township 22-19-3 is mostly sand-hills and is largely devoted to ranching. The southern part of tp. 23-19-3 is broken by South Saskatchewan river. A large portion of the lines in the vicinity of the river had to be cut through a dense and almost impassable bush of buckthorn. This part of the township is largely used for stock raising while the northern part is well settled and good farms were seen.

Leaving this district on September 24, we moved to tp. 12-18-3 which we resurveyed. The land in this township is nearly all patented and under crop, and seldom have I seen as good crops. The soil is very rich and there is usually plenty of moisture. Most of the settlers have very good homes and look very prosperous. I closed operations and disbanded my party on October 14.

APPENDIX No. 49.

ABSTRACT OF THE REPORT OF R. NEELANDS, D.L.S.

STADIA SURVEYS IN PRINCE ALBERT DISTRICT.

We left Prince Albert on May 22 for tp. 44-24-2 in which we closed operations the previous season. A large number of lakes and sloughs were found in the townships around Wakaw lake which were investigated. Many sloughs which existed at the time of the original survey having dried up, the section lines were produced across the dry beds and monuments erected thereon.

This district is comparatively new, and as much of the land requires to be cleared, settlement is slow. Mixed farming is the only industry for which the locality is suited. The surface is generally rolling with small bluffs of poplar and willow, and intervening stretches of prairie.

Having completed the work in the vicinity, we moved south on August 5 to the district around Humboldt, which is a good well-settled farming area. Some grain is grown, but mixed farming is the general industry. The surface is rolling, with some willow and poplar bluffs.

On September 15, we moved to Duck lake in tp. 44-2-3, and made stadia surveys in this and the surrounding townships. Along Saskatchewan river there is first-class farming land, the industry being divided between grain growing and mixed farming. Settlement here is comparatively old and most of the settlers are well established. The roads are all improved, and a branch of the Canadian Northern railway traverses the district.

The early part of the season was unusually cold and wet, and about ten days' time was lost on account of rain. The total amount of rainfall for the season, however, was below the average, and as the preceding year had been unusually dry the lakes were much below their normal low-water level, and most of the sloughs were dry by the end of August. In all five hundred and twenty-six miles of lake and river shore line were traversed and one hundred and twenty-nine miles of section line were resurveyed.

The crops in the Prince Albert district were good and the yield per acre was above the average. The crop was spoiled in a few places by rain and frost. The acreage under cultivation was increased by about eight per cent. Steady progress has been made in road building and in clearing and there is noticeable improvement from year to year, in the farming methods and in the condition of the settlers.

I closed operations for the season on October 27.

APPENDIX No. 50.

ABSTRACT OF THE REPORT OF W. H. NORRISH, D.L.S.

SURVEYS IN THE NEW WESTMINSTER DISTRICT, BRITISH COLUMBIA.

Our first work for the season was the survey of additional villa lots at Woodhaven. This subdivision is a distance of ten miles by water from Vancouver and is situated on Bedwell bay, which is part of the North arm of Burrard inlet.

We found Woodhaven to be heavily timbered with Douglas fir, hemlock and cedar. The ground was also found to be rather rough, a number of small cliffs being encountered. We were camped there from April 12 to May 17. During that time we completed the work in twelve blocks, and tied in and destroyed certain old monuments no longer required.

Our next work was to consist in establishing the north limit of the railway belt between Pitt and Harrison lakes, and as I was instructed to remain at Woodhaven only until such time as the weather was deemed favourable for work on the belt limit, I spent several days during the first week of May on an exploration trip to Pitt lake and up Osprey creek, in the direction in which the belt limit was to be produced. The post from which our work was to start was found to be on the peak of a mountain and deeply covered with snow, but the snow was melting rapidly and the weather was so favourable, that it was decided to commence work at once. Consequently on May 17, we moved from Woodhaven to Pitt lake, and established a base camp at the mouth of Osprey creek. The weather thus far had been exceedingly favourable, but a rainy spell set in, and from the 18th. to the 21st. the only work accomplished was the man-packing of supplies from the main camp to a cache five miles up Osprey creek. On May 21, we packed supplies and camp equipment to an altitude of approximately 4,200 feet above Pitt lake, and established our first fly camp near the post from which our survey was to commence.

The first mile of line was one of the most difficult encountered. In this distance we encountered two deep canyons which were only three chains apart. The second of these was about 1,000 feet deep and nearly 1,000 feet wide, and extended down the whole face of the mountain. Three camps were necessary to complete this first mile, nearly all of which was considerably above the snowline. On each move we had to man-pack the camp equipment over the highest parts of the snow-capped peaks. The weather continued to be very unfavourable, great delay being caused by the heavy fogs, which hung almost continuously on the peaks, and it was not until June 3, that we completed our first mile of line.

By the end of June we had completed five miles of the belt limit, and had established our eighth camp. During all this time supplies were being man-packed up Osprey creek from Pitt lake, and by means of side trails were taken high up on the peaks, it being our policy to maintain fly camps very close to the line, and thus avoid as far as possible tedious daily climbs to work. Up to the end of June we were able to make actual progress on an average of only one day out of three owing to weather conditions. The remainder of the time was largely used for man-packing supplies, exploring and trail cutting.

A launch had been rented for transporting supplies up Pitt river and Pitt lake to our first base camp. At the end of June this transportation route was found to be no longer feasible. Our main man-packing trail had been produced beyond the source of the east branch of Osprey creek and across the summit dividing Osprey

and Boulder creek watersheds at an altitude of more than 5,000 feet above Pitt lake. Ahead of us lay Boulder creek in a very narrow valley, nearly 2,000 feet deep with very steep precipitous sides. An exploration showed that it was going to be extremely difficult to man-pack supplies and camp equipment across this valley. I therefore decided to leave the party with food for about two weeks and the minimum camp equipment, and to establish a base camp at or near the head of Stave lake, and from there to man-pack supplies westward toward the party, who would in the meantime produce the belt limit across Boulder creek valley.

On July 2, supplies were taken from Ruskin to Stave falls on the Stave Lake railway, a steam railroad six miles in length, owned and operated by the Western Canada Power company. On the following day a launch owned by Abernethy and Lougheed, a logging firm operating on Stave lake, moved our outfit to the head of Stave lake and a base camp was established on Clearwater creek, one and one-half miles from the lake. We immediately commenced to cut a trail westward up Clearwater creek valley, and on July 8, three men from the line party who were looking for us found their way into camp. They reported that the belt limit had been produced about two miles since I had left, being carried across Boulder creek valley and over another high summit to the east branch of Boulder creek. Camp had been moved twice during the interval, and was established at a probable distance of ten miles from the base camp on Clearwater creek. In order to get supplies in, it was necessary to pack up a very steep mountain side lying to the south of Clearwater creek and over the summit at an altitude of probably 3,500 feet above Stave lake. The line was run about two miles farther from this camp and triangulated into Clearwater creek valley, a descent of over 4,000 feet. During the period from July 8 to 21, the hardest man-packing of the season was encountered. On the latter date camp was moved down into Clearwater creek valley and established about five miles from the base camp.

The distance triangulated in producing the line into this valley was about fifty-five chains, and considerable heavy cutting was necessary to run the duplicate bases, each thirty-nine chains in length. Consequently this triangulation was not completed until July 26.

After crossing Clearwater valley the belt limit ascended a burnt-over mountain with deep canyons running down its face, and numerous cliffs reaching an altitude of 4,000 feet at the NE. cor. sec. 1, tp. 6-3-7. No water was to be found on this mountain; it was therefore impossible to follow our general procedure of camping near the line. The work was consequently very tedious on account of the high climbs to and from work over burnt fallen timber and steep cliffs. On July 29, camp was moved to the base camp near the mouth of Clearwater creek. After completing the north boundary of section 1, the line turned north along the east boundary of section 12, and almost immediately dropped over an 1,800-foot precipice requiring another triangulation. In fact triangulations on the belt limit were quite frequent, two others having in the meantime been necessary to cross canyons on the face of Burnt mountain.

On August 7, we moved from Clearwater creek via Stave lake to a deserted logging camp on upper Stave river, about three miles above the lake, and established another main camp. During high water on upper Stave river supplies could be taken within about one and one-half miles of this camp by launch, and either man-packed or hauled by wagon over a logging road the remainder of the distance.

Extensive logging operations were being carried on in this vicinity during the summer by Abernethy and Lougheed, and they maintained a bi-weekly launch service between Stave falls and their various camps on the lake, for the purpose of taking in supplies. We were able to make arrangements with them for the transport of our provisions, etc. For our own convenience in carrying on triangulation work on the lake and getting to and from Stave falls, I purchased an attachable row-boat motor for use with a large row-boat which I brought from Woodhaven.

The belt limit after crossing Burnt mountain paralleled upper Stave river for the next mile and climbed a very rough shoulder to an altitude of about 3,500 feet, entailing some very heavy cutting, triangulation, and hard climbing, with the result that slow progress was made. It crossed upper Stave river on the E. by sec. 18, tp. 6-2-7. At this point connection was made with certain monuments established by Mr. J. E. Ross, D.L.S., in 1897. Both banks of upper Stave river were traversed through section 17. After leaving the main Stave river valley the line followed the east branch, known as Stump creek, and ran over some very steep cliffs along the base of a burnt-over mountain on the north side of the valley. The line had to be offset to get by some inaccessible points. On September 6, the line crossed Stump creek for the last time on the N. by sec.22, tp. 6-2-7, and commenced the ascent of a very steep precipitous mountain, rising to a height of probably 5,000 feet above the valley. The northeast corner of this section was witnessed at the foot of the cliff, fifteen chains from the corner, and as the weather appeared to be unfavourable for continuing the survey of the belt limit, I decided to move to tp. 21, E.C.M. and commence some subdivision surveys.

While engaged on the survey of the belt limit, my party consisted of ten or eleven men including myself. The labourers were all engaged with the understanding that they would man-pack supplies whenever necessary. Consequently, this heavy work was shifted from man to man, with better results than if certain men had been employed for that purpose only. The size of the line party was varied from day to day according to the amount of timber to be cut, the remainder being employed on exploration, trail cutting, and man-packing. On days when on account of weather conditions it was impossible to make progress on line the whole party was often employed on man-packing.

During the months of August and September, while the party was employed on the regular work, I spent several days in making connections with a system of triangulation established on the shores of Stave lake by the Western Canada Power company, and also with the SW. cor. sec. 23, tp. 4-3-7.

The portion of the country crossed by our belt limit surveys was very mountainous, being a portion of the Coast range. The mountains are of granite formation and rise to altitudes of from five to seven thousand feet above sea-level. In general they are heavily timbered, despite the fact that they are extremely rough. Cliffs are very numerous and were encountered from 1,000 to 4,000 feet in height. Canyons up to 1,000 feet in depth were crossed by the line. The commonest timber met with was hemlock, which ran up to four feet in diameter. White and Douglas fir of similar dimensions was fairly common, while in the valleys considerable cedar up to seven feet in diameter was encountered. Heavy stands of dry cedar were found on the base of Burnt mountain and on the burnt-over mountain lying to the north of Stump creek. In upper Stave river and Clearwater creek valleys, cedar of considerably larger dimensions were seen, while small clumps of spruce up to nine feet in diameter were seen. On the peaks cypress or yellow cedar was fairly thick and ran up to about six feet in diameter.

Practically all of the timber of commercial value in the vicinity is included in the various timber berths. Messrs. Abernethy and Lougheed who are the largest operators on Stave lake are taking off about three million feet of timber per month. The logs are boomed on the lake and towed to Stave falls, where they are loaded on cars, and taken over the Stave Lake railway to Ruskin, and again dumped in Stave river, boomed and towed down Fraser river to whatever mill purchases them. This timber consists mostly of cedar and fir and also a few spruce. A large number of shingle-bolts are being cut in the valley of upper Stave river in the vicinity of the belt limit, and also along lower Stave river and Cascade creek. These shingle-bolts are also towed to Stave falls in booms, and allowed to pass over the Western Canada Power company's dam. They are then carried by Stave river to the large shingle-mill located at Ruskin. At the time we left that vicinity it was estimated that about 4,000 cords of shingle-bolts

had been cut along upper Stave river and were ready to be floated down during high water in the fall.

Very little soil of any description was found. We did not find any first-class land, and my field notes show only small portions of second-class agricultural land in Clearwater creek and Stave river valleys. Even these portions are of little value on account of their distance from markets, the difficulties of transportation, and the amount of timber to be taken off to clear the land. In this connection it might be noted that the main reason for establishing this portion of the belt limit was not to throw open agricultural lands, but to settle certain disputes over valuable timber in the valley of upper Stave river.

Several large creeks or rivers were encountered, notably Osprey creek emptying into Pitt lake, Boulder creek flowing into Lillooet lake and Clearwater creek and upper Stave river flowing into Stave lake. These streams are all very rapid and are fed mostly by the melting snow on the peaks; consequently their flow is very uneven and is not very dependable for development of power. The valleys are very narrow and there is little chance to conserve the run-off at flood time by constructing dams. The fall per mile on these streams is very high but there are few falls. A large quantity of the power is now being developed at Stave falls by the Western Canada Power company, and is being used in Vancouver, New Westminster, most of the lower Fraser valley towns, and as far south as Sumas, Washington. This project has only been about half developed and there is still another site about two miles farther down Stave river where as much more power can be developed. In connection with this project, the level of Stave lake was considerably raised for storage purposes, and it is now intended to raise the elevation of the lake another twenty-five feet, by increasing the height of the dam at Stave falls . The valuable timber on the area to be flooded is now being removed.

The climate is comparatively mild with but little snow in the valleys, and a very heavy snowfall on the peaks. The average annual precipitation at Stave falls during the years 1910, 1911 and 1912 was 77·4 inches, but there is no doubt that it is much greater in the mountains traversed by the belt limit.

Minerals of economic value are very scarce though some traces of copper and iron are to be found. A number of claims have recently been staked near the head of Stave lake and are being prospected for iron ore.

Game is not very plentiful; a few mountain goats were seen and just one deer. No bears were seen although there where numerous evidences of their presence. Fish are fairly plentiful in Stave lake and some of the near-by creeks. They consist mostly of the common varieties of trout.

On September 8, we moved by way of Dewdney to sec. 1, tp. 18, E.C.M. During the following week we ran the west and north boundaries of sec. 6, tp. 21, E.C.M. and placed monuments for the legal subdivision corners.

On September 15, we moved to tp. 4-2-7 where we completed the subdivision of the good lands in sections 4, 8 and 9. A wagon road running up the east side of Hatzic valley connects this township with Mission and Dewdney and a new piece of road constructed this year now connects with the wagon road from Mission to Stave lake on the west side of Hatzic valley.

On September 30, we moved to Vancouver, and the following day moved by boat to Woodhaven to finish the work discontinued in the spring. Probably about half the lots fronting on Bedwell bay have now been built upon, and during the summer a number of families had resided at Woodhaven. There are at present two great hindrances to the development of this subdivision. First, a public landing place is badly needed. At present all the wharves are privately owned, and it is only through the courtesy of these owners that the passenger boats plying to and from Vancouver are able to land their passengers. Numerous other launch owners and holiday parties are greatly inconvenienced. Secondly, no roads have been built, and it will be impossible to build

cottages or houses on the lots away from the water's edge, until some roads are constructed to allow the transport of building materials.

The Harbour Shipping company operates a semi-daily boat service between points on the North arm of Burrard inlet and Vancouver during the summer, and a daily service during the winter. It takes from one to one and one-quarter hours to reach Vancouver from Woodhaven. Most of the residents are Vancouver business men, who go to the city every day. This resort is tenable during the entire year on account of the mildness of the coast climate, though at present it is popular as a summer resort.

On October 15, we moved to Vancouver where the party was disbanded for the season.

APPENDIX No. 51.

ABSTRACT OF THE REPORT OF P. E. PALMER, D.L.S.

STADIA SURVEYS IN SOUTHERN SASKATCHEWAN.

I organized my party at Regina, and on May 31, 1915, proceeded to Findlater in tp. 21-25-2 where the season's work was begun.

This work consisted of the investigation and survey of water areas in a block comprising townships 21 to 33, inclusive, range 25, west of the Second meridian to range 1, west of the Third meridian, inclusive. This kept us employed until October 22, when the party was disbanded.

The part of my work lying south of township 28 was in a thickly-settled country where but few stadia surveys were required. As a rule the amount of work done each day by the party in this district was only limited by the endurance of the horses. Under favourable circumstances a township could be thoroughly examined in a day. This section of the country is well provided with railways, and from an agricultural standpoint is one of the finest parts of Saskatchewan. Grain growing is the staple industry, and the towns and villages are merely supply and shipping points for the surrounding country. Probably the finest country included in my work was around Davidson, Craik, and Girvin, on the Regina-Saskatoon branch of the Canadian Northern railway. The excellent roads and well-built farmhouses and barns were conclusive evidence of the prosperity of the country. The districts around Eyebrow, Simpson, Imperial, Liberty, and Holdfast also show evidences of prosperity. Phenomenal crops of grain were harvested in all these localities in 1915.

Much of the country around Young is also excellent, but unfortunately much of the grain in that district was damaged by hail last season. However, owing to the excellent system of municipal hail insurance, conducted by the Saskatchewan Government, the individual losses to the farmers were slight.

A section of rough hilly country extends in a northwesterly direction from tp. 28-26-2 to tp. 31-1-3. This district is for the most part sparsely settled and has few roads or trails. It is not very suitable for agriculture, as much of the land is too rough and stony to be broken. It is however fine range country, though there are not many cattle on it at present on account of most of the land being homesteaded. Good roads are urgently needed for the development of this section. There are numerous small lakes through these hills, and consequently I was obliged to make a very close examination of this whole district. This work, on account of the absence of trails, was necessarily slow.

Manito lake was the only important body of water included in my season's work. This body of water, which is about thirteen miles long, lies in townships 32, ranges 24, 25, and 26. It is famous for the medicinal properties of its water, which contains various salts in solution, and has a very high specific gravity, so much so that the human body will not sink in it. This water is considered beneficial to persons suffering from rheumatism, sciatica, and various skin diseases. A large sanitarium was opened on the lake shore last summer, and many cottages are built at different points along the lake.

In secs. 33 and 34, tp. 30-28-2, are five small lakes whose waters are poisonous. They are strongly impregnated with alkali, and in some places have a reddish rusty colour. This alkali forms a slight crust over the surface of the water, and even on a windy day this crust remains intact, so that not a ripple disturbs it. These lakes do

not freeze in the winter, but the snow drifting in forms a sort of slush that will not bear the weight of a man. Several carcasses of cattle found lying in this vicinity testify to the deadly nature of the water. It is carefully avoided by the settlers of the neighbourhood.

Game such as prairie-chickens, ducks, and wild turkeys, was fairly abundant throughout this section of the country. The antelope however have entirely disappeared, the last having been seen three years ago.

APPENDIX No. 52.

ABSTRACT OF THE REPORT OF H. E. PEARSON, D.L.S.

SUBDIVISION SURVEYS NORTH OF ATHABASKA.

My work for the season of 1915 consisted of the subdivision of townships 70 and 72, range 20, townships 72 and 73, range 21, township 73, range 22, and the southerly two-thirds of townships 73, ranges 23, 24, and 25, all west of the Fourth meridian.

The only means of access to the western part of this district is by the Athabaska-Slave lake trail as far as Moose portage, thence by wagon road to Fawcett lake and then along the pack-trail leading to Calling lake. This trail is fairly good except where it crosses two or three soft swamps. The eastern part of the district is accessible in summer by wagon trail from Calling river, but for most of the season this trail is fit only for pack-horses. The easiest way to reach the district is by winter trail from Athabaska.

A number of fine lakes throughout this district such as Fawcett, Fife, Otter, and Calling lakes, teem with fish, and during the summer months are the homes of myriads of wild fowl. Calling lake is the scene of extensive fishing operations during the winter months, and many carloads of whitefish and pickerel taken from this lake have been shipped from Athabaska. To the few settlers who have made their homes on the east side of the lake, fishing is a never-failing industry.

The most urgent requirements of this whole district, in common with much of the north country, is drainage and trails. The soil for the greater part is a splendid loam suitable for growing the best of crops, but areas of swamp are found scattered throughout the whole district, and these act like a refrigerator on the surrounding atmosphere as they hold the frost until August, and many of them never thaw out. They are to some extent the cause of the late spring and early fall frosts, and while these are still prevalent grain cannot be grown successfully.

From my personal observation I would say that every one of these muskegs has an outlet, either at its edge or within a very short distance, which provides ample fall for drainage and only requires to be properly opened up. The difficulty and expense of successfully draining swamp lands is usually owing to the trouble of getting a sufficient outlet, but in this district the problem is simple from an engineering point of view.

Trails are needed badly, even more than railroads, but it is useless trying to build them until the land is drained.

The only industries suitable for this district at present are fishing, mixed farming and possibly enough lumbering to supply local demands.

APPENDIX No. 53.

ABSTRACT OF THE REPORT OF J. W. PIERCE, D.L.S.

SUBDIVISION SURVEYS NORTH OF MCMURRAY, ALBERTA.

My work consisted of the subdivision of lands along Athabaska river from township 97 to township 101 inclusive.

I left Edmonton with my party on May 21, 1915, and proceeded by train to Athabaska, where my assistant who had preceded me had arranged for scows and scow crews to take us down the river. We left there on May 22, and arrived at the head of Grand rapids on the 26th. At this point we were delayed for some time as there were several fleets of scows ahead of us using the portage facilities. At that time the Hudson's Bay company had on Grand Rapids island a small tramway equipped with push cars for transporting goods to the foot of the unnavigable part of the rapids. During the following summer however this equipment was moved north for use on the portage between Smith Landing and Fort Smith, on Slave river. I understand that the Hudson's Bay company have abandoned the Athabaska river route as a means of reaching their northern posts. They now ship their goods by train to Peace River Crossing and from there use Peace river as their main water route.

We left Grand rapids on May 28, and reached McMurray the next day. As there were no obstacles to navigation to be encountered below this point the services of the scow crews were dispensed with and the remainder of the trip was made without assistance.

Our survey work was confined to the district immediately adjacent to Athabaska river, and as it was thought probable that two-thirds of the work could be performed from camps situated on the river banks, it was not considered advisable to go to the expense of procuring pack-horses, with the incident cost of taking them to and from the work over trails which, in this district, are few and indirect, and of procuring feed for them. It was therefore decided to equip all the members of the party with pack-straps and pack-sheets, so that when it was necessary to take our camp outfit inland, all the party could act as pack-men. With this in view, silk tents, reflectors, and bake-kettles, on account of their portability, formed a part of our outfit, and were used to great advantage. For transportation along the river, three canvas canoes and a two-horsepower gasolene engine were satisfactorily used.

Survey work was commenced on June 2, and between that date and November 15, a total of five hundred and eight miles of line were cut, and seven hundred and twenty mounds erected. The season proved to be particularly suitable for surveying, only two days being lost from bad weather. There was, however, a loss of two and one-half days in the latter part of June, due to our party assisting the fire rangers in putting out a forest fire.

On November 16, the ice on the river being sufficiently firm for our needs, a traverse of the shores of Athabaska river and of the included islands was commenced. This work kept us busy until December 2.

We then loaded our outfit behind two freight teams previously engaged in McMurray and started for Edmonton. The route followed was on the ice of Athabaska river to McMurray, then by a winter road to Gregoire lake, and thence on the completed grade of the Alberta and Great Waterways railway until we met construction trains which took us to Lac la Biche. From there we took the regular train to Edmonton where we arrived on December 16. The party was disbanded the following day.

The most important town in the Athabaska district is McMurray, which is situated at the junction of Clearwater and Athabaska rivers. It is the terminus of the Alberta and Great Waterways railway, now under construction, and over which it is expected trains will be in operation by June 1916, as well as being at the base of up-stream navigation on the Athabaska. It is connected with the outside world by Government telegraph service and regular mails, and has a local telephone system, several well-stocked stores, good hotel accommodation, schools and churches. While it has suffered from the evils of an early real-estate boom, due to the prominence given to the oil and natural gas prospects of the adjacent country, it still presents a healthy thriving appearance. It is located in the centre of the extensive asphalt and tar deposits of northern Alberta. As yet no use has been made of these owing to their inaccessibility to markets, but it is hoped that this will be overcome by the operation of the railroad next year.

The Geological Survey have had parties engaged during the past few seasons in determining the location and extent of these deposits. I understand that some small shipments of this material, which have been tested in the pavements in Edmonton, have turned out satisfactory.

That part of Athabaska river crossing our work has an average width of about half a mile, and a current of about three miles per hour. Its banks vary from forty to seventy-five feet in height, and are usually close to the water's edge. An exception to this was noted in township 100, where a V-shaped flat, covering nine or ten square miles, occurs on the east side of the river. Through this flat Firebag river, a very sluggish, crooked stream about three chains wide, and several other smaller streams, empty into the Athabaska. Athabaska river contains numerous long, narrow islands; the largest of these are well timbered with cottonwood, poplar, and spruce, while the smaller ones are covered with willow only. About the beginning of July the river is subject to an abrupt rise from six to ten feet, due to the freshets from the mountains, and during this period many of the islands and adjoining flats are flooded. The water itself, which is naturally clear and fresh, assumes a dark muddy appearance and is barely fit for use. After about a month the water becomes clearer, and the river gradually subsides, until before the freeze-up, instead of presenting one broad sheet of water, it has given place to numerous narrow channels separated by islands and sandbars often half a mile long. Usually in low water, only one of these channels is navigable, and as this channel is constantly changing its position, due to the scouring action of the river, and to the sand deposited by the current, it follows that the navigation of this river will always present difficulties to even the most experienced pilots.

Several steamboats, the principal ones being owned by the Hudson's Bay company and the Northern Trading company, make more or less regular trips between McMurray and Chipewyan on lake Athabaska, from which point there is navigable water in all directions. In addition to these, there are numerous smaller steamboats and gasolene launches always ready to pick up custom.

The whole of the district surveyed by us this season is timbered with a healthy growth of spruce, poplar, jack pine, and tamarack, with occasional birch and balsam, the most valuable of which is found in the river valley and adjacent flats, and along the valleys of the tributary streams. Sound spruce, poplar, and tamarack up to thirty inches in diameter are to be found, and while the quantity is not great, it is of value on account of its accessibility to the river. In the southern part of tp. 97-10-5, near the base line, and across the southeast corner of tp. 97-9-5, are two high, rolling ridges each well timbered with spruce, jack pine, poplar, tamarack, and birch, up to twenty-five inches in diameter. Between these two ridges lies a very large muskeg and floating bog which drains into the most important lake in the district. This lake is situated in the southeast corner of tp. 98-9-5. It is probably five miles long by three across and empties through a small creek from its northeast corner into Muskeg river to

the east of our work. It is surrounded by low flat country, and is itself very shallow.

The area to the east of the Athabaska, with the exception of a narrow fringe along the banks of the river, is practically all sand plains and ridges interspersed with muskegs. The timber in the muskegs consists of spruce and tamarack, some of which reaches ten inches in diameter, while on the sand, the only timber is jack pine up to twelve inches in diameter. Unfortunately the greater portion of this sandy area has been burned over, and is now growing up with second-growth jack pine.

To the west of the river and outside of our work lies a range of high hills called Birch mountain. Through the western part of townships 98, 99, and 100, range 10, there is a large willow flat, the soil of which is of first quality. This appears to extend some distance westerly, but much of it has been flooded by the action of beavers. Between this flat and the river, the country is level or slightly rolling and is composed of muskegs and sand plains with occasional rolling country. Some of the sand plains have been burned over, but where they have escaped, they are covered with jack pine up to twenty inches in diameter. The rolling country is covered with mixed timber, of which spruce and jack pine up to twenty inches in diameter is the most important. Several small lakes appear in this district.

While much of the timber in this country is not now and possibly never will attain to the dimensions of what is now considered merchantable timber, it is suitable for pulp and box wood, the demand for which is constantly increasing. The district is zealously guarded from fire by a staff of Dominion fire rangers who patrol the district regularly, and are under the direction of a chief with headquarters at McMurray.

The soil on the plains is mostly sand, and is valueless for agricultural purposes. In the muskegs, it is of first quality and easily cleared, but extensive drainage operations would have to be undertaken before it could be utilized. On the uplands, where the timber is spruce and poplar, the soil is a light sandy clay covered by a few inches of decayed vegetable matter. This, while gravelly in places, would, if cleared, yield light crops. With the exception of the first-class soil in the large willow flat occupying the western part of townships 98, 99, and 100, range 10, previously referred to, the only good soil is found in the heavily-timbered flats of the river valley, the largest of which is on the east side of the river through township 100, range 9, and extending inland up the valley of Firebag river.

Hot days and cool nights with occasional frosts were prevalent through the summer months. On June 5, 6, and 7 there was sufficient frost to form a quarter of an inch of ice on water left in pails over night. The days are very long, there being scarcely any darkness during midsummer, so that vegetable growth is very rapid. At McMurray and McKay I saw potatoes, cabbage, onions, and all the other usual garden produce fully matured without injury from frost. Permanent ice first started to form on the river on the night of October 19, the bay and shallow water being frozen first, and the main channels remaining open; these gradually narrowed up and except in a few places, the river was entirely frozen by December 1. Inland lakes were all frozen over on November 1. The lowest temperature noted occurred on our return trip to Edmonton during the first part of December, when the thermometer reached eighteen degrees below zero.

A very important feature along Athabaska river is the presence of the tar and asphalt deposits, outcrops of which were noticed along the banks all through the work. The mounders occasionally encountered this asphalt when digging pits, so that apparently considerable of the underlying strata is of this formation. In two or three places at the foot of asphalt banks, small pools of what looked to be pure liquid tar had been formed, where it was possible to dip up a cupful at a time. No indications of the presence of other minerals of economic value were noticed.

All the usual fur-bearing animals and feathered game, common to northern Alberta, are found in this district, but it is specially noted as a good fox country. Red

and cross foxes and the various species of wolves are very common, while the presence of the rarer black and silver foxes was noticed. Beavers, mink, martens, and ermines are very numerous on all the streams and ponds back from the river. Moose, caribou, and bears were frequently seen.

Through the autumn months jackfish are very plentiful in the river, and the Indians have nets set in nearly every eddy along the bank in order to secure fish both for themselves and for their dogs. Each family puts up several thousand pounds of these fish, which are valued among themselves, at from eight to twelve cents a piece.

APPENDIX No. 54.

ABSTRACT OF THE REPORT OF T. H. PLUNKETT, D.L.S.

BASE LINE SURVEYS BETWEEN LAKES WINNIPEG AND WINNIPEGOSIS.

Our survey party left Winnipegosis on August 25, 1915, with sufficient supplies to survey the western portion of the 11th and 12th base lines between lakes Winnipeg and Winnipegosis, supplies for running the eastern half having been previously cached at Grand Rapids.

Landing half our supplies and all the party but five, at the 11th base line, with instructions to man-pack the outfit to the commencement of the work about two miles inland, I with the five men and the remaining half of the supplies sailed north to the 12th base line which had been discontinued in 1913 on the eastern shore of the lake. The remainder of our supplies were cached at this point.

We then rejoined the main party at the 11th base, and on September 1 work was commenced at the NE. cor. tp. 40-16-Pr.

This work was continued until October 11, when the line had been carried to the northeast corner of section 34, in range 13. Our means of transportation consisted of a combination of canoeing and man-packing. It was therefore imperative that a return to the 12th base be made before freeze-up, as our provisions were nearly exhausted, and much time would be lost in moving back if the ice had formed on the lakes crossed by the survey. We accordingly started back on October 11, following a splendid canoe route which we had explored during the season.

Work was commenced on the 12th base at the NE. cor. sec. 33, tp. 44-16-Pr. on October 19. Although the weather conditions at this time indicated an early freeze-up, the lakes remained open very late. The weather moderated about the end of October, and it was November 10 before the small lakes froze over, and the 25th before the ice was sufficiently firm to make travelling on the lakes safe. By November 13, sufficient snow had fallen to enable us to use dogs, and the men were thankful to be able to lay aside the pack-strap and tump-line.

By December 23 the 12th base had been completed to lake Winnipeg, and the block outline along the east boundaries of townships 45 and 46, range 13, had been surveyed to the 12th correction line. Camp was then moved to the 13th base line in range 13, and the survey of the east outline of this range southerly was commenced on December 28. A closing was made on the 12th correction line on January 7.

The weather until December 23 had remained mostly fair and moderate, affording ideal conditions for winter surveys. On December 24, however, winter assumed a different aspect; the weather became decidedly colder, and an almost continuous high west or northwest wind, with the temperature from 40 to 58 degrees below zero, made January anything but a pleasant month in this district. From December 24 until February 12, the cold was intense. During this period several tons of provisions and dog feed had to be moved south along lake Winnipeg and across Long point to the 12th base. The continuous winds filled up our trails every day, making work for the men and dogs very trying, and interfering materially with our progress.

On January 11 work was commenced at the northeast corner of township 44, range 11, and the block outline was surveyed south to the 11th correction line by January 31. A move was then made to the 11th base in range 12, where it had been discontinued in October. This point was reached on February 2.

Every effort was made to carry this base line to lake Winnipeg, but on February 13 the weather became milder, and for three days the thermometer registered 60 degrees

above zero. Much of our trail had to be recut, owing to the stumps and logs being laid bare by the melting snow. It had been expected that our stock of provisions would barely carry our survey to the lake, but this delay made it plain that unless we were to take great risks regarding the provisions necessary to reach Gypsumville, we must give up the idea of completing the base line. It was therefore decided to discontinue the survey at the east boundary of range 10. A start was made for Gypsumville on February 22.

The west shore of lake Winnipeg was followed south to the mouth of Warpath river. Much the shorter way to reach Gypsumville would have been to follow this river to the 9th correction line and then strike across country to Gypsumville, but Indians at Grand Rapids, who professed to have trapped on the Warpath, assured us that there was a beaten trail along the river throughout its length. After ascending the river for seven miles, however, the trail stopped, and from the end of this trail, for a distance of about forty miles by river, a new trail had to be broken on snow about three feet deep. Gypsumville was reached on the evening of March 2, and Winnipeg on the 4th.

The country covered by my surveys is by far the best, from an agricultural view point, that I have seen in northern Manitoba. On the 11th base in ranges 15, 14 and 13, the country is generally high and dry and fit for agriculture. In townships 39, 40, 41, and 42, in these ranges, large areas of good land were found, wooded with poplar and willow, and with sufficient open grass land to enable settlers to make an easy start at cultivation. The grass appeared to be of the better and more nutritious varieties, and quite superior to that found south on the 10th base. The whole country would be classed as bush, but clearing operations would meet with no special difficulties, as in most places the bush is very light and could be easily cleared.

This country is dotted with lakes. Pickerel and Sisib lakes, in townships 41 and 42, and Chitek lake immediately south of the base are fairly large. The two former have fine high gravel beaches, and in them pickerel and pike are plentiful. Chitek lake is inclined to be marshy around the shores.

The soil, in most places, is black loam on a clay subsoil, and the stratified limestone which underlies this whole country seems to be five or six feet below the surface.

Easterly from the middle of range 13, the country north and south of the base gradually becomes poorer; jack pine trees predominate, and the moss muskeg and bog, characteristic of northern Manitoba, is very much in evidence. The lakes, too, disappear and water-courses are seldom found. The base line here passes through almost continuous brush and dense small jack pine and spruce, but both north and south large areas of bog are found. The soil on the low land is the usual black muck, and on the ridges is gravelly or stony clay.

The country along the 13th base, in ranges 16, 15, and 14, and the westerly half of range 13, resembled that along the 11th base in the same ranges, and many areas fit for agriculture are to be found, but the country north of this line is not quite so favourable for farming as that through which the 11th base passes.

This too, is a lake country; Kawinaw, Katimik and Kanusk are large lakes. Katimik is a very fine lake with gravel beaches and bottom, and contains clear water. Surrounding Katimik, and portions of Kawinaw and Kanusk lakes, very fine spruce sufficient for settlers' requirements is found. Nets were set in these lakes but no fish were caught.

East of range 13, and north of the line, the lakes disappear, and moss muskegs prevail. The spruce on this moss-covered country has a much more healthy appearance than that usually found on such land, and has grown larger, occasional trees attaining a diameter of from twelve to sixteen inches. Along the base and south of it in ranges 12 and 11, jack pine is the prevailing variety of timber, with some patches of good spruce and poplar.

Along the east outline of range 11 in the south half of township 44, and in townships 43 and 42, a particularly good belt of timber extends almost due north and south. It consists of spruce up to twenty-four inches, poplar to eighteen inches, and jack

pine to fourteen inches in diameter, and of sufficient quantity to supply all local requirements for building or fencing material.

Speaking of this country as a whole, the portion suitable for settlement, in its present condition, lies along lake Winnipegosis, northerly from the 10th correction line, and includes all land within twenty miles of the lake.

Large game, such as moose, cariboo, and bears appear to be more plentiful there than in any part of northern Manitoba. Wolves, foxes, and lynx are also very numerous.

Fish are found in most of the smaller lakes and lakes Winnipeg and Winnipegosis are well-known fish producers. Mink, otters, and fishers are plentiful, and south of the 12th base little trapping is done by the Indians. Ducks abound on the inland lakes, but grouse, which a few years ago were numerous, have almost entirely disappeared. Rabbits too are not so plentiful as in former years.

The winter of 1915-1916 was a particularly severe one, not so much on account of extremely low temperatures, as on account of the almost continuous north and west winds. The snowfall was much heavier than usual, making travel through the country difficult.

APPENDIX No. 55.

ABSTRACT OF THE REPORT OF R. C. PURSER, D.L.S.

MISCELLANEOUS SURVEYS IN SASKATCHEWAN AND ALBERTA.

The surveys on which I was engaged last season were mostly small and of a varied nature, consisting of retracements for the purpose of correcting errors in old surveys, the establishment of section and quarter-section corners in places formerly covered by water but now dry, and the traverse of water areas. On this work I was accompanied by an assistant only, and procured labourers locally when they were required.

Work was commenced near Biggar, Sask., where small surveys were required in four different townships, and from there we moved to tps. 52 and 53-1-4, where a number of duplicate monuments were removed. Some of our lines in the latter township crossed Saskatchewan river, and we were fortunate in finishing this work just before the heavy floods which caused so much damage in Edmonton.

During the first three weeks of July we made a number of small correction and retracement surveys in central Alberta. The weather at that time was very wet, and the trails and roads became very bad, particularly where the soil was mostly clay. The continued rains however were good for the crops which were exceptionally large.

We next moved to the vicinity of Edmonton where several small surveys were required. One was in tp. 53-4-5 near the village of Wabamun on Wabamun lake. This village, as well as others situated on this lake, is used as a summer resort by the people of Edmonton, and is becoming very popular. It is about forty-five miles west of Edmonton, on the main line of the Grand Trunk Pacific, and affords excellent opportunities for boating, bathing and fishing. It is a favourite resort for picnic and excursion parties.

During the latter part of August and the first part of September two weeks were spent in tp. 57-5-4, where some errors in the original survey had to be corrected before certain road surveys, made by the Provincial Government, could be registered. This township lies north of Saskatchewan river and is about sixty miles from Vermilion, Alberta, a town on the Canadian Northern railway. Ferguson Flats post office and general store is in section 35; north and east of this there is very little settlement. The settlers have been only a short time in the district, but they are very enterprising, as is evidenced by the fact that there is a large regular service for shipping cream to Edmonton via Vermilion. Stock raising is the principal occupation, the long haul to town making grain growing, except for stock purposes, unprofitable.

After finishing this work we again moved to the central part of Alberta. In tp. 31-21-4, while engaged in running lines across Red Deer river, we met a party of Dominion Government geologists who were engaged in a systematic search for palæontological specimens for the Victoria museum at Ottawa. The valley of Red Deer river is about 300 feet deep and about two miles wide. The slopes are mostly bare, being too steep to be covered with vegetation, and there are many cut banks and ravines. This valley is rich in fossil remains, and affords excellent ground over which to work.

As it had been decided to close operations at the end of October, the remainder of our time was spent in finishing up all work of an urgent nature. One of these last surveys was a lake traverse in tp. 61-27-4, near the village of Westlock on the Edmonton Dunvegan and British Columbia railway.

On October 30 we closed our field work for the season and left Saskatoon for the east. In all about thiry different surveys were made, varying in length from a few days to three weeks.

In addition to our regular surveys, observations for magnetic dip and total force were taken whenever convenient.

APPENDIX No. 56.

ABSTRACT OF THE REPORT OF C. RINFRET, D.L.S.

STADIA SURVEYS IN THE REGINA DISTRICT.

My work consisted in the investigation of water areas in the district southeast, south, and southwest from Regina, comprising the block of townships 11 to 16, ranges 10 to 24, west of the Second meridian.

Since the district was surveyed in the early eighties, most of the sloughs and small lakes have dried up and are generally under cultivation or yielding hay. In a few townships even the wells are dry this season, and some farmers find it convenient to have their water supply brought in by the railways. Others haul it from public wells sunk here and there by the Provincial Government.

In this district there are many railway lines and the roads are graded. It has been settled for a long while and is mostly all under cultivation, being level and having a clay loam soil.

Some of the land is still in the hands of speculators, but is rapidly being bought by the neighbouring farmers who seem able to handle without trouble two or more sections with the help of modern machinery.

Some lakes were found in townships 12, 13, 14 and 15, range 10, and in townships 14, ranges 11 and 12; they have changed since first surveyed, but have still potable water, found very convenient by the surrounding settlers who, besides farming, raise some cattle.

Along Chapleau lake in township 14, range 12, a beaver colony was found.

Townships 15 and 16, range 10 were the only ones in which bush consisting of poplar up to six inches and willow, was found. They are sparsely settled although the land is all patented. The soil is good, and abundant water of good quality is found.

The southwest part of the block investigated is situated in the Dirt hills where, owing to the mountainous nature of the country and the numerous fresh-water lakes ranching only is successfully carried on.

Besides the district above mentioned three townships were investigated, township 9, range 23 and township 13, range 4, which are well settled by prosperous farmers, and township 3, range 19, which although nearly vacant is a splendid ranching area, being hilly and supplied with good water.

Besides investigating water areas, eighty-five section corners falling in dried-up beds of lakes were re-established.

APPENDIX No. 57.

ABSTRACT OF THE REPORT OF O. B. ROBERTS, D.L.S.

STADIA SURVEYS IN SOUNDING CREEK DISTRICT.

The area covered by my stadia surveys extends from Red Deer river to township 34, west of the Fourth meridian. Work was begun on May 28, in tp. 27-1-4.

Our work was greatly retarded during the first month in the field owing to excessive rains, as during the month of June we had twenty-seven days of rain. Although this wet weather was not very favourable for surveying operations it was however extremely beneficial to the farmers in the district where drought had greatly impoverished the country for the preceding few years. The district in the vicinity of the Fourth meridian is very rolling and contains much land useless for agricultural purposes. The lower land in the numerous valleys consists of good farming lands however, and is extensively worked. Although this district is comparatively newly settled it is in a very prosperous condition and under reasonable weather conditions would be one of the best farming districts in central Alberta.

On July 12, I began to move northerly leaving the traverse of Red Deer river until sometime later, and worked northerly as far as township 33.

On August 28, I began to move southerly again, arriving at Red Deer river on the 21st. I traversed the river through townships 22, ranges 2 and 3, and townships 23, ranges 3, 4, 7, and 8 and then moved northerly again in order to do certain surveys in townships for which special instructions had been given me.

Through the first eight ranges west of the Fourth meridian the country bordering on the north bank of Red Deer river for a depth of two townships is not suitable for farming purposes, but is admirable for stock-raising or ranching. In the valley of the river a scheme for irrigation was in course of construction.

The country travelled over throughout my entire district with the exception of those townships bordering on Red Deer river is of a similar nature. The surface is mostly rolling prairie with here and there some sections of hilly prairie. The district throughout is fairly well settled, and farming, the principal industry, is successfully carried on. The chief cereals grown are wheat, oats and flax. Immense crops were harvested throughout the entire district this year. Wheat yielded as high as sixty-four bushels to the acre, oats as high as one hundred and ten bushels, and flax as high as thirty-five. Under ordinary weather conditions and with good farming this locality is second to none for farming purposes. Twenty-five per cent of the roads are graded and the trails are invariably good.

After storing my outfit I left Alsask on November 2 for tp. 40-22-4. Mirror is a small town in this township with a population of about three hundred people. It is a divisional point on the railway and on account of its proximity to Buffalo lake is intended for a summer resort.

The land in this township is not suitable for farming purposes as the greater portion is either water or low lands. Some grain is grown however and cattle and horse raising is carried on extensively.

I completed work in this township, as far as conditions would permit and on November 11 closed operations for the season.

APPENDIX No. 58.

ABSTRACT OF THE REPORT OF O. ROLFSON, D.L.S.

SUBDIVISION SURVEYS EAST OF LAKE WINNIPEGOSIS.

I left Winnipeg with my party on May 17, 1915, and travelled by train to Winnipegosis. From there we proceeded by scow and tug to the scene of our season's operations in townships 35, 36, 37, and 38, range 15, and townships 37 and 38, ranges 16 and 17, all west of the Principal meridian.

Our first camp was located on the eastern shore of lake Winnipegosis in tp. 37-17-Pr. All camp moves in this township and the one to the north of it were made by canoe on the lake. The remainder of the work was carried on from camps on Inland and Waterhen lakes, boats being used for transport throughout the survey.

Our subdivision work was completed on September 9, on which date we moved south through Waterhen river to lake Winnipegosis by canoe, and across the lake to Winnipegosis by launch. On our arrival there I disbanded the party and commenced working on my final returns.

As it had been impossible for us to do all the traversing in summer, I returned with a small party on December 9, and completed this on the ice.We arrived back in Winnipegosis on January 15, 1916.

The land in this district is clay and clay loam with occasional gravel ridges. The surface is almost all timbered with spruce, poplar, birch,and a small amount of balsam with jack pine on the ridges, all varying from six to twelve inches in diameter. For a distance of half a mile inland from the shore of lake Winnipegosis, and in a timber berth on the east side of Waterhen lake, there is spruce and poplar up to twenty inches in diameter, but with the exception of this berth, there is in no place enough timber to warrant milling. In township 35, and the northerly one-third of township 34, range 15, the country has been burned over and only small poplar now remains.

In most places the land near the lakes is dry, while farther inland it is swampy. Not having run levels over the lines, I cannot speak with certainty, but I believe it will be possible to drain all of this land. To do this properly would require a system extending over the whole district. When this is done, I am sure that the district will be suited for farming. Some parts will require no artificial drainage.

Moose and deer are very plentiful, while caribou and bears are found occasionally. The ordinary fur-bearing animals, such as mink, otters, beavers, etc., are very scarce. Whitefish, jackfish, goldeye, pickerel, and perch are found in lake Winnipegosis.

The town of Winnipegosis, which is situated near the south end of lake Winnipegosis, is the distributing point for the district. A lumber mill is located there, and a branch line of the Canadian Northern railway from Dauphin runs to the town. Many settlers are going into the district north of Winnipegosis and some are commencing to raise cattle on the land near the mouth of Waterhen river.

Fishing is still the chief industry of the district, and during the season of 1914-1915 about five million pounds of fish were shipped from Winnipegosis.

APPENDIX No. 59.

ABSTRACT OF THE REPORT OF W. A. SCOTT, D.L.S.

SUBDIVISION SURVEYS IN EASTERN MANITOBA.

I left Winnipeg where my party was organized, on May 14, and proceeded by Grand Trunk Pacific railway to Ophir station in tp. 10-17-E, and from there by canoe to tp. 13-15-E where our season's work was commenced.

After the completion of this township we subdivided all of tp. 14-15-E, tp. 13-16-E, and parts of tp. 15-15-E and tp. 13-17-E. This work was completed with the exception of the traverse work, in the latter part of October. The party was disbanded on October 28 and on January 8, 1916, another small party was organized for the traverse work which had been left to be done on the ice.

The country covered during the summer is quite rough and rocky. The elevation of the land as a whole is fairly uniform and all of it is timbered. About twenty per cent is rock of the Laurentian formation and of no value, even the timber being small, and about fifteen per cent is covered by lakes. Of the remainder, probably half is swamp and half dry land, covered with poplar. Many of the swamps could be easily drained and would make good farming land, while the poplar land is first class for farming. The best land is usually found bordering on the larger lakes, while the smaller lakes are frequently surrounded by swamps. Many of these small lakes have no outlet and sometimes no inlet, and the larger lakes have but small outlets. The variation in the elevation of the water in the lakes is also very small, probably not more than two feet at the greatest. The combination of the lakes and swamps makes a vast reservoir for the conservation of water supply.

The only stream of importance touched by our survey was Whiteshell river. This river consists of a series of lakes connected by long stretches of river with very little current, but broken at intervals by small falls. It enters tp. 13-15-E in section 1, leaves in section 2, enters again in section 6, and finally leaves the township in section 18. In the latter section there is a fall of about twelve feet. As the river has a very constant flow one hundred horse-power could be developed at this point with but little expenditure for dams. Between this point and Winnipeg river there are many falls and rapids which would aggregate not less than one hundred feet. Many of these could be easily developed.

The most important lake in this area is lake George in tps. 14 and 15-15-E. This lake is approximately seven miles long and one mile wide, and along the shore are many sand beaches. It is a beautiful sheet of clear, fresh water and contains many islands. It abounds with trout and other kinds of fish, and its shores would make an ideal summer resort. It is, however, rather difficult of access at present. A fine club house belonging to the Manitoba Hunting and Fishing Club, is situated at the north end of the lake, and a number of squatters are located at the south end. These settlers are badly in need of a road. At present their only means of getting in is from Point du Bois across Winnipeg river and lake George by boat.

The traversing was completed and the party paid off on February 29, 1916.

APPENDIX No 60.

ABSTRACT OF THE REPORT OF F. V. SEIBERT, D.L.S.

SURVEY OF THE 27TH. BASE LINE BETWEEN THE FOURTH AND FIFTH MERIDIANS.

The party left Athabaska on April 21 with scows loaded with supplies for the season's survey, while the pack-horses were sent overland via Lac La Biche to McMurray. There they were taken aboard the scows and the whole outfit proceeded down the Athabaska to the latitude of the base line.

After building caches and cutting trails in the vicinity of the base line, we commenced the survey of the line at the Fourth meridian on May 22, and on June 12 we were again camped on Athabaska river with the line completed to within a few miles of the river. In the meantime I had had the country west of the Athabaska explored for trail. While some of the party were cutting trail and moving supplies we surveyed fourteen and a half miles of outline on the east boundary of range 9, two and a half miles north and twelve miles south of the base line. When the supplies were moved about fifteen miles west, work was continued on the base line west of the river, and on September 23, it was permanently closed on the Fifth meridian. The party left the line on September 25, and travelling by way of Wabiskaw and Sawridge, arrived at Edmonton on October 17.

The country east of Athabaska river for twelve miles on either side of the line has very little agricultural value, being mostly muskeg and ridges of sand or boulders. Ranges 1, 2, and 3 contain most of the boulder ridges, while the other ranges contain most of the sand ridges. This whole area should be made a forest reserve. Very little merchantable timber grows there now, except along the streams. This has been chiefly the result of fires, as owing to the sandy nature of the country fires start easily, and judging from appearances, they have been sweeping the country every few years. The soil is very light and the growth does not start readily. With care I believe it can be made to produce considerable timber, mostly jack pine, but on the other hand continuous fires will leave it only a desert.

Athabaska river crosses the line in range 9. The valley is shallow and averages a mile in width, while the river channel averages one-half mile wide, with many islands and sandbars. The depth of the water varies with the season, and is always sufficient for steamboats of shallow draft. Some good spruce grows along the banks, and the land in the river flats is all good.

West from the Athabaska to the foot of Birch mountains in range 12 the country is rolling, with some large areas of muskeg. The dry land is light, some of it sand, and the remainder a sandy loam. Jack pine and spruce are the main timbers. Near the foot of the mountains more clay is found and the timber is larger, with more spruce and poplar and less jack pine. McIvor river in range 12, though crooked, is navigable for canoes north of the line. Its main source is in Birch mountains, and it is a typical mountain stream. During two days' rain in July it rose eight feet.

Birch mountains, beginning in range 12, are largely glacial deposits. A few limestone and sandstone ledges were noted on the eastern slope, but most of the cuts, and there were many, show boulder clay. The summit, in ranges 13, 14, and 15, is a plateau, largely muskeg and low jack pine ridges of sand, gravel, and boulders. The northern slope lies a few miles north of the base line. It is very steep in ranges 12 and 13, but towards the west it becomes gradually less steep. This slope is heavily timbered with spruce, poplar, and birch. All the creeks running out of

the mountains have large ravines and gorges, some of which are 800 feet deep and extend into the hills from one to five miles. The country north of the hills has considerable land fit for agriculture.

There is no well-defined western slope. From range 15 the country slopes gradually west and north, and on this slope there is much land fit for agriculture and many areas of spruce and poplar of merchantable size. On the lower areas of this slope there is more open land, and many fine meadows. None of the creeks in this area were navigable for canoes. Birch river in range 24 however, is navigable for twelve miles on each side of the line. The elevation of this river at the line is 848 feet, while the elevation of its mouth at lake Claire is 710 feet. This is a fall of about 140 feet in a distance of over 100 miles and would indicate that it has few rapids, and is probably navigable for the whole distance.

The profile of the line shows a more or less gradual slope from the Fourth meridian, elevation 1,265 feet, to Athabaska river, elevation 723 feet, a rolling line to the valley of McIvor river in range 12, elevation 803 feet, a rough and broken ascent, very steep in places, to the summit of Birch mountains in range 14, elevation 2,559 feet, and a gradual slope to the Fifth meridian, elevation 800 feet, with a number of deep creek valleys breaking into the slope. The levels show that the country can be easily drained, and that even the worst muskegs and swamps have good drainage possibilities.

East of Athabaska river feed for the horses was scarce. It was also scarce from the river west to range 18; beyond that it was plentiful.

The dry weather in August and September helped very much in the progress of the work, making the muskegs easier to cross. It also improved the trail which we followed coming out. This trail in a wet season would be bad in many places, particularly from township 104 to Chipewyan lake.

Many bears were seen east of the Athabaska, and west of the river wolves were plentiful. Other fur-bearing animals were scarce due no doubt to the scarcity of rabbits. Jackfish were seen in nearly all the lakes and streams and whitefish were seen in Athabaska river and some of the lakes to the east of it.

No minerals were noted.

APPENDIX No. 61.

ABSTRACT OF THE REPORT OF H. M. R. SOARS, D.L.S.

STADIA SURVEYS IN THE VICINITY OF EDMONTON.

The party was organized at Edmonton, and on May 21, we left for our first work in tp. 51-23-4.

During the first part of the season we made stadia surveys of all lakes and sloughs over five acres in extent and investigated all water areas in townships 48 to 50, inclusive, ranges 22 and 23, and townships 48 and 49, range 21, all west of the Fourth meridian.

The character of the land is fairly uniform throughout these townships; the surface is rolling or undulating with many poplar bluffs. Lakes and sloughs are very numerous, and the feed both in the sloughs and on the uplands is abundant. There is ample wood for fuel and fencing. The district is well settled and improved, particularly in range 23. The settlers are of mixed nationalities, with Germans and Russians predominating.

The Edmonton-Camrose branch of the Canadian Northern railway crosses this block of townships from the southeast to the northwest. The main business and shipping centre is at Hay Lakes station in sec. 7, tp. 49-21-4. Considerable quantities of cream and butter are shipped from this point to Edmonton and Camrose. The trail from Hay Lakes to Edmonton, which parallels the railway through these townships, is rough and heavy, and the side trails are almost impassable in the spring and after heavy rains. The main trail is not travelled very much, as supplies can be purchased at Hay Lakes at reasonable prices. Very little road improvement seems to have been done during the last few years. There is however a fairly good trail connection with the Canadian Pacific railway to the west.

The largest sheet of water in this district is Big Hay lake in townships 48, ranges 22 and 23. This is more of the nature of a large slough than a lake: the water is not very good, and it contains no fish.

Owing to the fact that a certain amount of drainage has been carried into it from the north and that the south outlet has become badly choked up, this lake has overrun its old shore lines and much valuable hay land has become inundated. The water has also backed up into the tributary sloughs and mud holes, causing the adjacent roads to be very heavy. The present north shore line of the lake appears to be about two miles north of the old shore line and the water on this new area is from two to four feet deep. Until the outlet is cleaned out and deepened this lake and the many adjacent lakes and sloughs will be far above normal. Little Hay lake in townships 48 and 49, range 21, has also increased in area through the obstruction of its outlet, and much valuable hay land is now flooded. Township 50, range 22 has almost one-third of its surface covered with large and small lakes and sloughs, all of which will eventually be drained as the land increases in value.

Another large lake of very different character is Miquelon lake in townships 49, ranges 20 and 21. I traversed that part in tp. 49-21-4, the remainder having been traversed en 1912. A depth of forty feet was found on the east boundary of this township and it is doubtless deeper in tp. 49-20-4. The water is good and there are very few reeds, although in the fall the surface becomes covered with small green algae, giving it a scummy appearance. No outlet or inlet was noticed and I am given to understand that no outlet of any kind exists, thus explaining the absence of fish. The

banks are well defined, in many cases being clay cut-banks. The surrounding country for four or five miles back is rough and densely wooded with poplar and willow.

The crops through all these townships were exceedingly heavy in 1915, oats and wheat in some cases averaging one hundred bushels and sixty-five bushels per acre, respectively. The vegetable crop was also very heavy. Hail and early frosts do not seem to be prevalent, and it is exceedingly rare that a crop failure is reported. The whole district seems to be most suitable for mixed farming.

We next moved over good trails to townships 57, 58 and 59, ranges 18 and 19, investigating on the way townships 50, ranges 17, 18, 19 and 20, townships 51, ranges 16 and 19 and township 54 range 17. These latter townships do not contain so many water areas as those to the west, but the character of the surface and the vegetation is very similar. Some traces of alkali were noticed in the townships south and east of Beaverhills lake. The roads are good, and the district is well served by railways. The main lines of the Canadian Pacific and Canadian Northern railways as well as a local branch from each, cross these townships. The crops were exceedingly heavy and were not touched by hail or frost.

From there north across Saskatchewan river the settlers are nearly all German, Austrian and Russian. Smoky Lake post office in tp. 59-17-4 is the centre of a thickly-populated Bukowinian settlement; many large well-built churches were seen, and the settlers appeared to be prosperous. This district was originally covered with a dense growth of poplar, but a large acreage has now been cleared, and many good farm buildings are in evidence. Unfortunately the district here was hailed out in 1915.

On completion of townships 58 and 59, range 18, a move was made across the Saskatchewan to townships 57 and 58, ranges 18 and 19.

The country here does not appear to be quite as fertile as on the north side of the river; there are many jack pine sand ridges rising out of numerous large marshes, especially in tp. 57-18-4. Nevertheless every available quarter-section is taken up by a Galician or Bukowinian. A good trail extends from this district to Lamont on the Canadian Northern railway, and an excellent trail runs along the north bank of the river to Edmonton. A new branch of the Canadian Northern railway is in course of construction from Oliver, near Edmonton, along the north side of Saskatchewan river to Battleford.

Camp was next moved to those townships immediately east of Edmonton. Naturally these townships have been settled and well improved for many years, excepting the east half of tp. 53-21-4 and that part of tp. 54-20-4 lying west of Cooking Lake Forest reserve. These parts are rather rough and are covered with brulé and small sloughs. The crops from this district were exceptionally heavy but some hail was experienced in tp. 55-22-4. For many years miners have worked the gravel bars in Saskatchewan river through these townships, and have often taken out from two to five dollars per day in very fine gold. The source of this gold supply has never been found, but it is not very far up the Saskatchewan, as no gold appears in the upper reaches, and yet after the spring floods the bars which have been worked out in previous years again pay for working. A great deal of soft coal is also mined from the banks of the river in this district.

On completion of these townships we moved south again to complete the survey of a number of lakes in the south half of tp. 48-22-4, which could not be done economically until the ice had formed.

The last work of the season was some miscellaneous surveys in tp. 51-3-5 and tp. 58-3-5. The party was disbanded at Edmonton on November 30.

APPENDIX No. 62.

ABSTRACT OF THE REPORT OF N. C. STEWART, D.L.S.

SURVEYS IN THE REVELSTOKE DISTRICT, BRITISH COLUMBIA.

On April 17, I left Golden with my party and pitched camp at Glenogle, a station about seven miles up Kicking Horse river from Golden. From this camp we traversed Kicking Horse river through townships 27, ranges 20 and 21, west of the Fifth meridian, and surveyed all the quarter-sections of these townships through which the Canadian Pacific railway passes. Near the E. By. sec. 6, tp. 27-20-5, the river enters the lower canyon, which extends in a westerly direction for about seven miles. Surveying in this canyon was very difficult owing not only to the hard climbing, but also to the fact that the river could be crossed only in a few places. There is practically no agricultural land along the river in these townships.

On May 18, we moved to Palliser station in tp. 26-20-5, whence we continued our work along the railway, and on June 8, we moved to Leanchoil. The next day we took the trail to the south travelling seventeen miles, and on the 9th we pitched camp near where Kootenay river crosses the south limit of the railway belt. Several days were spent in taking in the remainder of our supplies from Leanchoil and in cutting trails. On June 14, we moved to the southeast quarter of sec. 13 tp. 25-17-5 and began the survey of the belt limit eastward from the SW. cor. sec. 18, tp. 24-16-5.

On June 18, we extended our trail to the northeast quarter of section 20, where good feed for the horses was found at the foot of snow slides. By cruising ahead it was found that we could not take our horses over the summit of the Vermilion range, but that by man-packing, a light outfit could be carried over to the headwaters of a creek running into Vermilion river. It was therefore decided to send the pack-train around via Field and Castle Mountain with all the outfit which could be spared, leaving the main party to man-pack a fly-camp outfit across the summit, and construct a trail out to the Banff-Windermere road to connect with the pack-train when it got around. This plan was carried out but with extreme hardship owing to the weather conditions. During the night of June 25, six inches of snow fell, and on the next day as much more. On June 27, we moved over the summit, taking turns in breaking a trail through the fresh snow; it took us eight hours to go three miles. We had several narrow escapes from snowslides, and were all suffering from sunburns and snow-blindness. On June 29, we cut a trail out to the Banff-Windermere road; the pack-train reached camp the next day.

From the middle of section 20 to the southeast corner of section 33, the belt limit is situated above timberline on high and in some places, inaccessible peaks. The line crosses the summit of the Vermilion range at approximately 8,200 feet above sea-level. On the west side of this range there are numerous cirque lakes and snow-fields, and on the east side are large glaciers, snowfields, and moraines. The glaciers on the east side are the sources of creeks which tumble down the mountain sides into a heavily-wooded valley nearly 2,000 feet below. The main stream, which is about fifty links wide and three feet deep, flows in a northerly direction through sec. 33, tp. 24-16-5, and secs. 4, 9, and 16, tp. 25-16-5, and then easterly through section 22 to Vermilion river. The belt line descends into the creek valley and then crosses a high ridge into the valley of Vermilion river. Timberline is again reached on the S. By. sec. 10, tp. 24-16-5, the southeast corner at that section being over 8,000 feet high. The eastern slopes of this ridge are very precipitous, being composed of shale cliffs and steep shale slides, over which we could not chain. We were delayed on this ridge by wet, misty weather and a snowstorm or two.

The line crosses Vermilion river in the northeast quarter of sec. 15, tp. 25-16-5; at this point the river is three chains wide, between four and five feet deep, and very swift. The line then crosses the Banff-Windermere road and ascends the sides of Vermilion peak, passing about two chains west of the summit at an altitude of 8,500 feet, and again abruptly descends into Vermilion valley.

Through townships 26, ranges 16 and 15, the belt limit zigzags up the densely wooded valley of Vermilion river, which there flows in a southwesterly direction. In sec. 16, tp. 26-15-5, the summit of the main range of the Rocky Mountain system was reached at an altitude of 8,300 feet, and a tie was made to a cairn established on the boundary between Alberta and British Columbia by the Interprovincial Boundary Commission in 1913.

The valleys of the Vermilion and its tributaries are heavily timbered with marketable spruce and balsam. The timber is easily accessible, though most of it is in the park reserve. On some of the tributaries mining claims have been staked, and some of these are still being worked. The ochre and marble deposits along the wagon road are fairly well known.

Big game, consisting of moose, elk, deer, goats, mountain sheep, mountain lions, and bears is plentiful in the valleys of Kootenay and Vermilion rivers. Fur-bearing animals such as beavers, mink, and martens are also plentiful and porcupines are too plentiful. Ptarmigan were seen on the high peaks, and the Kootenay and its tributaries teem with trout.

Having completed this part of the belt line, we moved on August 5, to Castle Mountain and the next day to Golden, where we repaired and replenished our outfit for another hard trip to the south limit of the railway belt in tp. 24-22-5. We left Carbonate Landing on August 10, and reached Copper creek late that evening. The trail is in very poor condition, chiefly on account of rotten bridges and corduroy. On August 11 and 12, we built a bridge across the middle fork of Spillimacheen river and re-opened the old trail up Copper creek to the northeast quarter of section 2, tp. 24-22-5, and on the following day moved our camp to the end of the trail.

Our work consisted in retracing the old surveys in Copper creek valley in townships 24, ranges 21 and 22, and in making ties by triangulation to Amyot triangulation station. Copper creek valley is about 6,000 feet above sea level, and the moutain tops adjacent to it are all above timberline. The slopes of these mountains are very rough and broken and covered with slide paths, while the bottom of the valley is filled with boulders and debris from the slides. At the head of the valley there are several glaciers. Spillimacheen river valley is noted for grizzly bear hunting. At one time there was considerable mining in the district.

On August 23, we moved to tp. 27-22-5 where we surveyed the south and west boundaries of section 34 and completed the traverse of Columbia river. We then moved camp to Moberly in tp. 28-22-5, where we surveyed parts of sections 4, 8, and 16, and completed the traverse of Columbia river as far as the north boundary of section 19.

On September 20, we commenced subdivision work in the southeast quarter of tp. 29-22-5, in the valley of Blaeberry river. This was completed by October 1, and we moved back to the mouth of the Blaeberry in tp. 28-22-5, where we surveyed parts of section 20, and completed the traverse of Columbia river.

On October 11, we moved to Golden and on the following day made some alterations in the survey of the northeast quarter of sec. 8, tp. 27-22-5, after which the party was disbanded for the season.

APPENDIX No. 63.

ABSTRACT OF THE REPORT OF P. B. STREET, D.L.S.

SUBDIVISION SURVEYS ALONG THE HUDSON BAY RAILWAY IN NORTHERN MANITOBA.

My surveys of last season were made during the fall and winter months, and were confined to the lands along the Hudson Bay railway in townships 71, 72, and 73, ranges 2, 3, 4 and 5, west of the Principal meridian.

I left Pas with my party on August 4, and travelled by train on the Hudson Bay railway to mile 172, near where our first camp was located. The only accommodation train running on this line is a mixed one, which is operated by the Hudson Bay Construction company, and which makes a weekly trip to the end of steel. The trip takes a day and a half, each way.

The railway was being ballasted last summer and autumn, and gravel trains sped past our camp at thirty-five miles an hour, which speaks well for the condition of the road-bed.

The greater part of the district surveyed is covered with a thick growth of timber, but most of it is too small to be of commercial value. Some larger timber is to be found in places, but this is all being used for railway ties. The soil is for the most part clay, and is stony in places.

Townships 73, ranges 2 and 3, are badly cut up by Landing and Wintering lakes. These lakes have steep rocky shores, and are fairly deep, forty feet being a common depth at the centre while a depth of twenty feet is usually found within fifty yards of the shores. Fishing is carried on in both lakes, whitefish, tullibee, jackfish, and pickerel being plentiful. The district between these lakes is noted for its almost impenetrable thickets of small spruce.

Our work was completed on March 22, and the party was disbanded at Pas on the 24th.

The winter season of 1915-1916 was unsatisfactory for survey work owing to incessant winds and repeated snowfalls. The temperature was not as low as the average winter, but high winds made work in the open much more unpleasant. I have never before seen so much suffering from repeated frost-bites as the men were compelled to endure. The track of the Hudson Bay railway was covered with snow practically all the time, and we were unable to use our hand-car from December 1 up to the time we stopped our surveys for the season.

The lack of game was one of the unusual features noticed on the trip. The country bordering on Wintering and Landing lakes should be excellent for chickens and partridges, as berries are plentiful, and the land is dry and clean. No partridges were seen, however, and practically no ducks. No signs of moose were noticed until late in January, when the excessively deep snow in this district evidently attracted them as a refuge from the timber-wolves. As there was no crust on the snow a wolf would not travel over it. No wolf tracks were seen all winter, but lynx were plentiful, eight being caught by one of my men, who set snares and traps along our survey lines.

No indications of minerals were seen. We ran across several mineral claims which were staked some time ago and subsequently abandoned.

A fox farm was started near Thicket portage in township 73, range 2, but the venture was not a success this season owing to an epidemic which affected most of the fox farms in this country. The owner had thirty-two full grown foxes in January, and lost twenty-nine by the first of March.

A fur trader and general merchant, who has about half an acre of garden at mile 185 on the railway, succeeded in raising excellent vegetables last summer. At a contractor's old camp at mile 169, in township 71, range 4, a splendid growth of timothy hay, perfectly ripened, was seen last August, the hay having come up wild from seed dropped in feeding horses at this spot. Frosts occur late in August and in early September, but evidently do not affect the growth in the early summer.

The Hudson Bay railway has been completed to mile 237, the first crossing of Nelson river. A steel cantilever bridge was built over the river at this point during the winter, and as the grade was finished up to mile 320, it was the intention to proceed with the track-laying as soon as the snow disappeared. At mile 320 the railway crosses the Nelson a second time, so there will be some delay while a second bridge is being erected.

APPENDIX No. 64.

ABSTRACT OF THE REPORT OF A. G. STUART, D.L.S.

RETRACEMENT OF BASE LINES AND MERIDIANS IN SASKATCHEWAN AND ALBERTA.

My instructions called for the retracement of the 9th base line between the Second and Fifth meridians, of the Fifth meridian from the northeast corner township 32, to the northeast corner township 14, and of the Fourth meridian from the northeast corner township 51, to the northeast corner section 1, township 62, where a series of latitude observations had been taken several seasons previous.

On April 23, I left Kamsack, Saskatchewan, where my party was organized, and proceeded by wagon across Kee-See-Koose Indian reserve to where the retracement work was commenced at the NE. cor. sec. 36, tp. 32-1-2.

In connection with the retracement surveys a line of precise levels and an independent line of check levels were run. In order to obtain a commencement datum, a tie-line was run from rail level at Pelly station on the Canadian Northern railway to our commencement point at the intersection of the 9th base and the Second meridian. During the summer as the work progressed, water levels at all lakes and streams, and rail elevations at all railway stations near the line, were obtained. Bench-marks were established in most of the villages, towns and cities in the vicinity of the retracement, and connections were made with several bench-marks previously established on other important lines of levels.

The 9th base line, as far as Quill lake in ranges 17 and 18, west of the Second meridian, passes through bush country and in places there are long stretches of low, swampy land. This section of the country is well adapted for mixed farming, sufficient rainfall being assured owing to a large area of timbered land. There is, however, great need for improvement in the building of roads, as in many places there is no road opened along the base line. The settlers, who are mostly of foreign birth, are thirfty and industrious, but they are handicapped by lack of capital, and primitive methods of farming have greatly retarded their progress.

West of Quill lake the country is mostly open prairie, with excellent roads and railway connections available in all directions. The main exception is in ranges 19, 20, and 21, west of the Fourth meridian where some broken hills were encountered, and where the country is exceedingly rough; this district is used for grazing purposes. Roads were not accessible on many of the section lines and transportation became difficult. The agricultural resources of the country are being well developed, and the crops were in splendid condition. We reached the Third meridian on June 4, the Fourth meridian on July 13, and the Fifth meridian on August 20.

After the completion of this base line retracement was continued south along the Fifth meridian, Calgary being passed about September 1. South of Calgary Bow river crosses the meridian in several places. The current in this river is swift and treacherous and the water cold, and as no boats of any description were available, work became difficult to perform and a series of large triangles for obtaining chainage had to be resorted to. In this region and southerly along the meridian considerable bush country was crossed, much cutting being required in order to produce the line. The nature of the country changed to heavily rolling prairie and many grazing herds were seen. The only available roads were some distance from the meridian. On September 18, we reached the northeast corner of township 14, where the work on the Fifth meridian was discontinued.

We then travelled east to the railway where the party, with the exception of four men, was discharged. We then proceeded by way of Calgary and Edmonton to Lloydminster, and thence northerly by wagon to the NE. cor. tp. 51-1-4, where we commenced the retracement of the Fourth meridian on September 29. We found the country heavily wooded with poplar, tamarack, spruce, jack pine, willow, and scrub, and as the old lines were grown up a great deal of cutting was necessary. Several half-breeds who were excellent axemen and woodsmen were engaged at Onion Lake and the work proceeded as rapidly as possible. The only road available for transportation was an old trail which leads to Cold Lake I. R. and which is about five miles distant from the meridian; this necessitated long hard walks to and from work. In township 58, the road turned westerly and as the country to the north as far as Beaver river was heavily wooded and swampy in many places, it became necessary, in order to complete the retracement, to make rough pack-saddles, and use a small pack outfit for the remaining nineteen miles of line. This was completed to the NE. cor. sec. 1, tp. 62-1-5, on October 19.

Moose and caribou were very plentiful in this district. It is very interesting to note that at a reserve west of this locality it was reported that the Indians were threshing between twenty and thirty thousand bushels of their own grain.

During the field season 677 miles were retraced, necessitating the taking of 500 azimuth observations. These lines were also levelled and check levelled, and in addition to this many level tie-lines were run.

APPENDIX No. 65.

ABSTRACT OF THE REPORT OF C. H. TAGGART, D.L.S.

SURVEYS IN THE KAMLOOPS DISTRICT, BRITISH COLUMBIA.

The first work of the season was in tp. 18-15-6, where we completed the subdivision of that part of the township lying outside of Monté Hills Forest reserve.

Most of this township is used for stock ranging purposes for which it is well suited on account of the abundance of water and the heavy growth of bunch grass. This year the grain crops on the cultivated parts were excellent.

Campbell creek in range 16 draws most of its supply of water from the western portion of the forest reserve. A good deal of inconvenience was caused to the farmers lower down the creek who use its waters for irrigation purposes, by the beavers damming back the headwaters on Scuittoe creek and other tributaries.

A few of the homesteaders hunt and trap in the forest reserve during the open season and appear to have very good success, especially at trapping. Deer are rather scarce and difficult to find.

The outfit was next moved to tp. 19-15-6, where the boundaries of lot 706 were retraced and tied to the Dominion Lands system of survey. This lot is a valuable hay and cattle ranch. Sufficient land is now cleared to produce hay to winter 500 head of cattle. The owner irrigates the greater part of the land by flooding it in May for a depth of from a few inches to a foot or more; when warm, growing weather comes the water is drained off.

The next move, which required nearly two days, was along the Kamloops-Vernon wagon road to tp. 17-11-6. The survey of sections 26 to 30 was made, thus completing the subdivision of the northerly portion of the township outside of Fly Hill Forest reserve and timber berth No. 441. These sections lie on mount Connaught which is 1,500 to 2,500 feet above the valley and is densely timbered on top.

Several mining prospects were noticed on this mountain, particularly on the southern slope, which is openly timbered with pine and easily prospected. A large number of location posts were noticed but nothing of great value seems to have been found.

The Canadian Northern railway branch line from Kamloops to Vernon has been located and surveyed through Salmon river valley in this township. Naturally it has been a keen disappointment to the settlers but probably more so to the land speculators, that construction work on the railway has not been commenced. It would in all probability have been commenced two years ago had it not been for the financial depression.

The survey of the railway belt limit across ranges 11 and 12 was the next work undertaken. For this purpose the camp was moved to section 18, township 17, range 10. After running about a mile of line a fly camp was taken by pack-train into section 11, whence the belt boundary was carried to the northwest corner of section 10. In order to take the pack-train into this section it was necessary to open out a hunter's trail, which followed Moffat creek as far as the tributary leading into section 11. In places where this trail was unsuitable it was necessary to open out a new trail.

We then moved back to the bridge on Salmon river near the middle of range 11, from which point we completed the belt line across the range, and produced the interior meridians down to the belt line.

The camp was next moved to a point near the west boundary of range 11, whence the belt boundary was produced into range 12, after which we moved by pack-train

to Pinaus lake. The work was completed from this camp. Some subdivision was also performed in sections 18, 19, 29, and 30 of this township.

The valley of Salmon river, which crosses this township, is very fertile and is devoted to mixed farming. The climate is comparable to that of some parts of western Ontario.

We next moved to sec. 6, tp. 18-11-6 and completed the subdivision of the southwest portion of this township lying outside Fly Hill Forest reserve and from there moved to Paxton valley in tp. 18-13-6. The subdivision of sections 9, 10, 14, 15, and 22 to 26 in this township was completed and the boundary of Martin Mountain Forest reserve was surveyed.

This completed the eastern end of the season's work. The outfit was moved to Kamloops, and from there up North Thompson river road as far as sec. 26, tp. 22-17-6, where a small survey was performed. From there we moved to lot 371 G. I. in tp. 20-19-6, where the boundaries of this lot and of lot 2, G. II were retraced and tied to the Dominion Lands system. The adjoining mineral lots were also tied in.

We next moved to Cornwall's ranch in tp. 19-19-6, and completed the subdivision of the portion of this township lying outside of Long Lake Forest reserve. Portions of this land are suitable for agriculture and are already entered for. Grain farming and stock ranching are carried on with success. Parts of secs. 26 and 27, tp. 19-18-6 were also surveyed while we were in that vicinity.

The outfit was then moved back to Kamloops and from here to Pinantan lake in tp. 20-15-6, where the survey of sections 14 and 23 were completed. Only a small portion of these sections is suitable for agriculture; stock could be grazed on part of the remainder. The soil is heavy clay and would probably be very productive.

The party returned to Kamloops on October 15, and was disbanded for the season.

The weather conditions during the first part of the season were very unfavourable for survey operations. From the time we moved to Salmon river valley until we left Pinaus lake rain and fog were of almost daily occurrence. Particularly at the higher altitudes rain fell very frequently. At the end of May snow fell on Mt. Connaught and Mt. Tuktakamin. The fact that the yield of grain in the dry unirrigated areas of the Kamloops district was twice or three times the usual amount shows that the rainfall was abnormal. During the latter part of the season the weather was fine.

APPENDIX No. 66.

ABSTRACT OF THE REPORT OF G. A. TIPPER, D.L.S.,

SUBDIVISION SURVEYS IN THE GRANDE PRAIRIE DISTRICT, ALBERTA.

My surveys for the season of 1915 consisted of the subdivision of township 77, range 4, township 76, and the southerly two-thirds of township 77, range 6, and townships 77 and 78, and the east half of township 76, range 7, all west of the Sixth meridian.

I left Edmonton, where my party was organized, on April 25, and travelled by the Edmonton Dunvegan and British Columbia railway to the end of steel, which at that time had reached Reno, a station about thirty miles from Peace River Crossing. From there we travelled by wagon via Peace River Crossing, Dunvegan, and Spirit River settlement to the scene of our first work in tp. 77-4-6, where we arrived on May 8.

The trails from Reno to our destination were in very poor condition owing to the fact that the frost was just coming out of the ground, and to the excessive rains. It is perhaps worthy of note that when our surveys commenced on May 8, the frost was practically all out of the ground.

The area covered by my surveys is mostly rolling and lightly wooded. The main exception is a range of hills about 175 feet in height known as White mountain, extending from sec. 20, tp. 77-6-6, westerly through the middle of tp. 77-7-6. From the summit of this range an extensive view of the surrounding country can be obtained and the Waterhole district which is twenty-five miles distant across Peace river can be seen quite plainly. These hills are mostly heavily wooded with spruce.

Spirit River settlement which lies in townships 78, ranges 5 and 6, is a thriving community. A townsite of the same name has been located in sec. 22, tp. 78-6-6. The road-bed of the Edmonton Dunvegan and British Columbia railway was graded as far as this townsite and it was expected that steel would be laid that far shortly after the close of our surveys.

By September 21, we had completed our surveys with the exception of some traverses. Most of the party were therefore sent to Edmonton and disbanded. The remainder after completing these traverses reached Edmonton on October 16.

APPENDIX No. 67.

ABSTRACT OF THE REPORT OF J. W. TYRRELL, D.L.S.

SUBDIVISION SURVEYS NORTH OF LAKE ST. MARTIN.

My field work for the season of 1915 consisted of the subdivision of a strip of land about three miles wide, on each side of Dauphin river from lake St. Martin to lake Winnipeg.

This district may be reached by boat either from lake Winnipeg via Dauphin river, or from Fairford, on the Canadian Northern railway via Fairford river, lake St. Martin and Dauphin river. The latter route can be used to advantage with small boats or canoes but is not suitable for large vessels. Dauphin river has a few slight rapids, but none that cannot be easily navigated by small boats or canoes although tracking has to be resorted to in places.

There is a well-travelled road leading from Fairford through Sandy Bay and Lake St. Martin Indian reserves, as far as the 9th base line which was the southern limit of our work. From there we cut a road following near the west bank of lake St. Martin and the left bank of Dauphin river throughout its length. The road is fairly good in dry seasons of the year, but it is too soft for heavy loads in wet seasons. The railroad to Gypsumville might easily be extended through this district. Some location surveys have already been made through tps. 34 and 35-7-Pr. and tp. 35-6-Pr.

Dauphin river is of the greatest value to this district, forming as it does an excellent water route, furnishing an excellent supply of fresh water, and providing good fishing. It is from five to ten chains in width and from six to twelve feet deep except in a few places where there are rapids, and flows at a rate of two to four miles per hour. We found that we could use boats and canoes carrying a ton or more, by using tracking-lines when ascending the rapids. By doing some dredging in the rapids this river could be made navigable for fairly large boats. Throughout the lower half the banks of the river are from eight to forty feet high, so that by damming considerable power could be developed.

Jumping river which flows in a northeasterly direction from the NE. cor. tp. 35-6-Pr. to lake Winnipeg, is also a useful river for transportation being from ten to fifteen feet wide and about six feet deep with a current of about three miles per hour.

There is some excellent timber, suitable for milling, in the northern part of tp. 37-7-Pr. and the northeastern part of 34-5-Pr. The remainder of the district is nearly all covered with small timber which will be useful to the settlers as fuel, and for building purposes but it is not enough for lumber.

The chief industries of the district will likely be farming and grazing. There are some excellent hay meadows from one-quarter to three-quarters of a mile wide along the west and north of lake St. Martin and along both sides of Dauphin river extending from its head as far as the elbow in tp. 35-7-Pr. and a number of smaller meadows in tp. 35-6-Pr. These meadows are exceptionally suitable for grazing purposes.

The east halves of tps. 33 and 34-7-Pr. and the southeast quarter of tp. 35-7-Pr., are chiefly rolling land, covered with small timber, with a number of swamps. There is also a similar area one-quarter to one-half mile wide on each side of the lower half of Dauphin river. The soil in these areas is chiefly black loam to a depth of four to six inches, with clay subsoil. They could all be drained into Dauphin river and lake St. Martin and thus made into good farm land. Townships 33, 34 and 35, range 6,

and townships 34 and 35, range 5, are chiefly composed of spruce and tamarack swamp covered with moss to a depth of two to four feet, with black muck beneath. This district could be easily drained into Dauphin river, but it would require considerable time to convert the moss and muck into good farm land.

Moose, elk and caribou and smaller game such as mink, muskrats, weasels, etc., are numerous in the whole of this district, and whitefish, pickerel and jackfish are quite plentiful in lake St. Martin, Dauphin river, and lake Winnipeg, affording another industry of considerable importance.

On the whole, however, this district is best suited for farm settlement. Within the last year a number of settlers have taken up land in the surrounding townships and a few have already settled in the southern part of the newly-surveyed district. With a little capital and intelligent development work on the part of these settlers, there is every prospect that the Dauphin river district will soon become a prosperous mixed-farming and stock-raising settlement.

APPENDIX No. 68.

ABSTRACT OF THE REPORT OF W. H. WADDELL, D.L.S.

SUBDIVISION SURVEYS NORTH OF LAC LA BICHE.

The work on which I was engaged during the past season consisted of the subdivision of townships north of Lac La Biche along the right of way of the Alberta and Great Waterways railway between the 19th and 21st base lines. The grade of this railway is completed to McMurray but the steel is laid only as far as tp. 78-7-4.

The area subdivided contains very little land suited to general agricultural pursuits, being for the most part composed of muskeg separated in nearly all cases by sand or heavy clay ridges with very little fertile surface soil. Very small areas of this fertile soil are found along some of the streams, but these form an insignificant portion of the area subdivided, and it is very doubtful that even this is of much value in the present undeveloped state of the district, as killing summer frosts appear to be very frequent. Attempts were made to raise some garden produce along Christina river during the summer, but this was practically a total failure. It is possible however that should an extensive system of drainage be undertaken and I believe that the muskegs could be drained comparatively easily, a great part of the district could be reclaimed. This would also remove the cause of the severe and frequent frosts.

APPENDIX No. 69.

ABSTRACT OF THE REPORT OF C. M. WALKER, D.L.S.

MISCELLANEOUS SURVEYS IN MANITOBA, SASKATCHEWAN AND ALBERTA.

My work was of such a scattered nature that it was thought advisable not to organize a regular party. Accordingly I was accompanied by an assistant only, and hired labourers locally as they were required.

Our first work was the subdivision of lands suitable for summer resort lots, bordering on Sandy lake in sec. 9, tp. 18-20-Pr. The southern shore of this lake is admirably suited for a summer resort. The sandy beach has a very gradual slope and the water in summer is sufficiently warm for bathing. Wooded islands are scatterred throughout the lake which is about five miles in length, and splendid fishing is to be had in this and the adjoining lakes, of which there are many.

At the time of my survey the resident population of Sandy Lake village numbered about 100, but I was told that during the summer months of an average season from 800 to 1,200 persons may be found in the tents and cottages in the immediate vicinity. It can be reached by Canadian Northern railway and there are good automobile roads connecting it with the towns to the east, south and west.

The surrounding district is well suited for mixed farming and the northern end of the lake adjoins Riding Mountain Forest reserve, which is plentifully supplied with large game such as moose, caribou, elk and deer.

Our next work was the survey of a small settlement near Badger station on the Canadian Northern railway in sec. 6, tp. 3-12-E. A number of half-breeds and others had squatted on this section and are making a living by cutting cordwood in the surrounding district. This district is mostly composed of sand ridges, thickly covered with jack pine and spruce, and it is of little value from an agricultural stand-point. During the summer months the settlers help to make out an existence by gathering and shipping to Winnipeg large quantities of blueberries, blackberries, and raspberries, which grow in great profusion along the sand ridges.

On completion of this work we moved to the village of Woodridge in sec. 3, tp. 4-10-E. to lay out lots for about thirty squatters. After considerable difficulty a plan of subdivision was agreed upon which apparently gave satisfaction, and about fifty lots were laid out.

We then moved to Banff, Alberta, and on June 14th, began work on the preliminary survey of an addition to the townsite of Banff, to be known as the St. Julien subdivision. We also made a preliminary survey of a cemetery site near Tunnel mountain and made some other minor surveys in the vicinity.

Our next move was to tp. 1-26-4, where an improperly placed monument was corrected, and from there to tp. 22-5-4 to traverse a portion of Elbow river through the township. We then spent several weeks on small miscellaneous and correction surveys in southwestern Saskatchewan. The townships visited were tp. 13-28-3, tp. 11-23-3, tps. 12, 13 and 14-23-3 and tps. 10 and 12-16-3.

Two weeks were spent in making further surveys at Banff and when this was completed on September 9, we again returned to southwestern Saskatchewan where we were employed for about six weeks on further miscellaneous surveys in tp. 18-18-3, tp. 18-19-3, tps. 19 and 20-15-3, tps. 15 to 18-7-3, tps. 16 and 20-6-3, tp. 16-4-3 and tp. 15-5-3.

On October 18 we moved to tp. 3-22-Pr. and subdivided the dried-up bed of Whitewater lake. This work occupied about two weeks and we again returned to Banff to make the final survey of St. Julien subdivision. This work was urgently required in order that a number of alien enemies who had been interned at Banff might be given winter employment, clearing the streets and avenues of the new subdivision. The Dominion Parks Branch supplied us with a number of labourers to assist in this survey which kept us busy until December 14 when we closed operations.

During the season observations for magnetic dip and total force were taken whenever our other work permitted.

APPENDIX No. 70.

REPORT OF J. N. WALLACE, D.L.S.

LEVELLING IN MANITOBA, SASKATCHEWAN AND ALBERTA.

The work of last season was advanced along the same general lines as in previous years with the notable addition that levels were inaugurated in connection with the subdivision of townships.

Four classes of levels are now carried out. The first class consists of precise levels, almost invariably run along railway lines. All lines are run independently in both a forward and backward direction, and unless these duplicate lines agree within 0.017 feet in a mile section, the section must be levelled again. Practically the discrepancy seldom exceeds 0.010 feet in a single mile, with an accumulation well within 0.017 feet $\sqrt{}$ miles.

The second class comprises levels run along travelled roads or other routes where no railway is available as a route. The main object of this class of levels is to supply, in the partly settled districts, lines which will radiate through the general system of levels, and will act as a control in keeping down the accumulation of error. These levels rank next in accuracy to precise levels. The discrepancy allowed is 0.030 feet $\sqrt{}$ miles. The extent of these levels is very restricted owing to lack of available routes of almost any kind.

The levels run along meridians and base lines during their original survey form the third class. These were the first levels inaugurated and, at the present time, form much the greatest proportion (74.2 per cent) of the total mileage levelled. The lines nearly all run through districts which are timbered and are as yet devoid of settlement. The allowable discrepancy is 0.10 feet in a mile section, with an accumulation not greater than in proportion to the square root of the miles.

The fourth class are the levels which are run during subdivision of townships, the pratice being to run these along alternate section lines, forming closed circuits of eight miles each.

Some reconnaissance levels were also run last season with a view to ascertaining the approximate elevations of streams, lakes, and other features scattered over partly-settled districts which had been surveyed before levels were inaugurated. The great difficulty in running such levels may be briefly stated as due to the impossibility of finding the difference of elevation of two points without having to run lines of levels, not desired in themselves, between the two points. It is not intended to continue these levels until some form of instrument may be available in which speed is given more attention than great accuracy. The best general design is a level in which the telescope is capable of being moved about ten degrees in a vertical plane, so that each time the instrument is set up, the line of sight can be elevated or depressed to suit the slope of the ground. The backward and forward rods are read as usual, and the sights subsequently corrected for each angle of slope.

The levels carried out during the twelve months are as follows:—

	Miles.
Meridian and base line levels	1,671
Precise levels	730
Subdivision levels	854
Other lines of levels	181
Total for the season	3,436

(The above does not include 168 miles of reconnaissance levels taken northeast of Edmonton.)

The total mileage is an increase of 622 miles over the total of the previous year. Meridian and base line levels show a decrease of 638 miles, while there was an increase in precise levels of 225 miles.

The mileage of all levels run in each season since their inauguration is as follows:—

Season.	Meridian and base line levels.	Precise levels.	Other levels.	Totals.
	Miles.	Miles.	Miles.	Miles.
1905	114	.....	.....	114
1908	116	.....	.....	116
1909	613	.....	.....	613
1910	757	.....	.....	757
1911	1,326	.....	116	1,442
1912	1,433	497	70	2,000
1913	1,992	567	72	2,631
1914	2,309	505	.....	2,814
1915	1,671	730	1,035	3,436
Totals	10,331	2,299	1,293	13,923

It will be noted that the total of all levels now reaches the large amount of 13,923 miles.

Meridian and base line levels.

Seven parties were engaged in the survey of meridians and base lines, including one party on retracement of lines which were surveyed many years ago. All of these surveyors took levels. No work was done in the northeastern part of Manitoba near Hudson bay, as a large amount of work had been done there the previous year. Farther south in Manitoba the levels along block outlines run near the east shore of lake Winnipeg were continued southerly. These lines are required as a basis for future surveys, as there is no meridian available in that locality, owing to the lake interfering with access to the Principal meridian. The levels were continued on these lines during the past season from township 37 to township 27, and a connection was made, near their southerly end, across a narrow part of lake Winnipeg, to the levels run up from the south along the Principal meridian. The datum of the levels along the meridian had been derived from a precise bench-mark at Gretna, close to the international boundary, while the levels run southerly, near the east shore of lake Winnipeg, were run on an assumed datum. The connection across the lake, along the 8th base line, thus afforded a good datum for the levels on the east shore. The elevation of lake Winnipeg was taken frequently during the progress of these levels. Its average elevation for the months May to October is about 715 feet above mean sea-level.

Between the Principal and Second meridians sixty-eight miles were levelled between lakes Winnipeg and Winnipegosis along the 11th and 12th base lines, and forty-eight miles along outlines between the 11th and 13th base lines. The gap previously existing on the 15th base line between Playgreen lake and range 21, was also levelled this past season, and the part between this range and the Second meridian was relevelled. The levels on this base line and on the 16th base line were connected by a line along the east of range 21.

It was stated in last year's report that the system of levels had been connected with the tide-gauge at Nelson on Hudson bay. This connection has been worked out, and it is found that the elevations carried northeasterly over the lines of levels are 5·65 feet too high at Nelson, when compared with mean sea-level as recorded by the tide-gauge. The datum used in the system was derived from a bench-mark of the United States Coast and Geodetic Survey at Stephen, a place in the State

of Minnesota about forty miles south of Emerson, Manitoba. The total length of the various connected lines of levels from Stephen to Hudson bay is about 1,580 miles. The last 435 miles of this distance consists of levels run during the original survey of meridians and base lines, which are run on a straight course across uninhabited country amid swamps and other very unfavourable surroundings. The closing, therefore, can be regarded only as a preliminary approximation, pending the completion of the precise levels over the last 320 miles of the Hudson bay railway.

It will be seen from the foregoing that 414 miles of meridian and base line levels were run last season in what may be termed the eastern part of the territory, that is the part east of the Second meridian.

In the central part, between the Second and Fourth meridians, levels were run along the 9th base line (north boundary of township 32) from the Second to the Fourth meridian, and were then continued westerly to the Fifth meridian. This line crosses a well-settled prairie country. Numerous connections were made to bench-marks of other intersecting lines, and the elevations of all important topographical features along or near the line were recorded. Levels were run by the same party to close a gap along the Fourth meridian between township 53, and township 60. There is now a continuous line of levels along the Fourth meridian from the international boundary to the south of lake Athabaska in township 115.

West of the Fourth meridian the 27th base line was levelled along its whole length and was closed on the Fifth meridian; also a short distance was levelled along the east of range 9, extending a few miles north and south of the base line. All the base lines from the 19th to the 27th inclusive have now been levelled between the Fourth and Fifth meridians, making nine connections in all.

In the country between the Fifth and Sixth meridians levels were run along the 24th and 25th base lines across ranges 1 to 17, west of the Fifth meridian, ranges 18 to 21 having been levelled in the year 1913.

The Sixth meridian levels were advanced 216 miles, being continued from township 90 to township 126, reaching a point two miles north of the north boundary of Alberta. This is the farthest north to which levels have yet been carried. The previous northerly records of the levels were the Fourth meridian levelled to township 95 in the year 1910, the Fifth meridian to township 112 in the year 1911, and then the Fourth meridian continued to township 115 in the year 1913.

The lengths of continuous levels along the several meridians is now as follows:—Principal meridian, (excepting lake Winnipeg) townships 1 to 88, 448 miles; Second meridian, townships 56 to 85, 171 miles; Third meridian, townships 53 to 72, 120 miles; Fourth meridian, townships 1 to 115, 686 miles; Fifth meridian, townships 71 to 112, 247 miles; Sixth meridian, townshlps 85 to 126, 252 miles; These undoubtedly include the longest straight lines of continuous spirit-levels in the world.

In addition to continuing the levels of the Sixth meridian to township 126, the same surveyor levelled the last sixteen miles of the 27th base and closed on the Sixth meridian; he also made a connection with the levels at the westerly end of the 29th base, this base having been surveyed in the previous year as far west as the Sixth meridian before the meridian had been surveyed so far north. There are now three direct connections along base lines between the levels of the Fifth and Sixth meridians, namely the 23rd, the 27th, and the 29th base lines.

Levels taken during the subdivision of townships.

Last season levels were taken for the first time in connection with the subdivision of townships by four of the subdivision parties. One of these was working in south-eastern Manitoba, one northeast of Prince Albert, one between Edmonton and Lesser Slave lake, and the fourth about fifteen miles northeast of the town of Peace River

Crossing. The system followed was to take levels along such of the four outlines of each township as were being surveyed and in addition, along every alternate section line running east and west, and north and south, across the township. These lines form nine circuits of eight miles each. The levels along the meridian outlines are checked; the other levels are not checked, reliance being placed on the closings of the several circuits to detect errors. The limit of error allowed is that each mile of the meridian outlines should be checked by a second line agreeing within 0·10 feet, and that each eight-mile circuit should close within one foot. Allowing two of the outlines to each township, the lines indicated above comprise thirty-six miles of levelled lines to seventy-two miles of surveyed lines in each township. Adding the check levels, the leveller would have to run about 72 per cent of the final surveyed mileage.

Three of the subdivision parties levelled 264 miles, 260 miles, and 238 miles, an average of 254 miles, while the fourth party levelled 92 miles, making a total of 854 miles. The records made in the field include the elevation of the ground at every quarter of a mile along the lines levelled and of the water in all streams and lakes crossed by the lines. Sufficient information has been obtained to enable topographical plans of each township to be prepared to the extent of marking the positions of contours across the lines levelled and sketching in their connections from one line to the next. While the latter is not supposed to be an absolutely accurate representation of the ground, yet the connections of the contours from one crossing to another greatly assist in identifying the positions where a certain contour crosses the various lines of levels.

Lines of precise levels.

Precise levels were run along the Grand Trunk Pacific railway from Portage la Prairie to Goodeve, a distance of 247 miles, and along the Canadian Northern railway from Saskatoon to Rosebud, a distance of 339 miles, making a total of 586 miles. These levels were run strictly as precise levels. A third line was run from Grouard to Dunvegan by way of the town of Peace River Crossing, using the travelled road. While not run so strictly as the other two lines it has been included in the mileage of precise levels.

The line of levels along the Grand Trunk Pacific railway was carried out by Mr. L. O. R. Dozois, D.L.S., between May 10 and August 28, at an average rate of 67.4 miles of double line per month. Mr. Dozois adopted a new schedule of working hours in order to utilize those hours of the day which are most free from wind and disturbed air. The former is so bad on prairie work, except in the early morning and late afternoon hours, that many days are entirely unfit for precise levelling under the ordinary schedule of hours from 7 a.m. to 6 p.m. Mr. Dozois arranged the hours of actual levelling so that about four hours' work was done before 8.30 a.m., and another four hours' work after 4 p.m. The results showed a decided increase in accuracy and decrease in cost. The probable error of the mean result per mile of double levelling of this line, 247 miles long is —0.0022 feet, which equals the best class of levelling carried out anywhere.

Mr. E. W. Berry, D.L.S., had charge of the second line of precise levels which was run along the Canadian Northern railway. He commenced work at Saskatoon on May 14, and ended at Rosebud on October 20, having completed 339 miles at an average rate of 63.6 miles of double line per month. The probable error of the mean result per mile has not yet been computed, but an inspection of his discrepancies shows that it is very small. The accumulated discrepancy is —0.013 feet at the end of the 339 miles, with a maximum of —0.129 feet at mile 120.

The line from Grouard to Dunvegan was run by Mr. L. E. S. Bolton, D.L.S., between June 11 and October 8. Precise methods were followed but owing to the large percentage of re-running required to keep within the limit of 0·017 feet, this limit was relaxed to the extent of not requiring occasional miles to be rerun if the discrepancy was within 0·030 feet. The main object of this line was to supply a new and better

datum for the Sixth meridian and all levels west of it than the former datum which had been dependent on the levels of the 23rd base line west of the Fifth meridian, long regarded as unsatisfactory. The length of the main line is 144 miles. In addition 32 miles of branch lines were run, making a total of 176 miles. The datum used was derived from the levels run from Edmonton to the east end of Lesser Slave lake in previous years. The lake is some seventy miles long, and the datum was transferred to Grouard at the west end by comparison of the gauges established by the Irrigation Branch. For this purpose the records of the daily readings for over a month were used. The mean elevation of the water at each end of the lake as deduced from these readings was assumed to be the same absolute elevation, and the relative elevations of the two zeros were thus found. The lines of levels running to the east and west ends of the lake were then connected to each zero, and the datum was in this way carried across the lake.

Miscellaneous lines of levels.

After completing the line of precise levels to Goodeve, Mr. Dozois levelled a line along the Canadian Northern railway between Swan River and Pelly, and along a travelled road from Pelly to the intersection of the Second meridian and the 9th base line. This was required in order to make a connection between Swan River and the point of commencement of the levels run westerly along the 9th base line, by Mr. A. G. Stuart, D.L.S., during the season. The connection is forty-three miles long, and was completed on September 15. From that date till November 30, he was engaged on reconnaissance levels in the district near St. Paul de Metis and Cold lake, during which time 168 miles of approximate levels were run.

Later on, in the early part of March, 1916, Mr. Dozois levelled a connection of eight miles from Mr. Christie's subdivision levels in tp. 54-23-2 to Candle lake. There was no known datum available for the subdivision levels, and it would have been too costly to level from Prince Albert. The elevation of Candle lake, however had been ascertained when the 15th base line was run in the year 1913, and this was considered sufficiently accurate to serve as a datum for the present. This connection occupied Mr. Dozois from February 27 to March 11 though the party was actually in the field only eight days. Considerable time was necessarily spent in getting from Calgary to the place and back again.

Another connection run to subdivision levels, for the purpose of supplying a known datum, was that levelled by E. W. Berry, D.L.S., from Mr. Lighthall's subdivision levels in tp. 63-7-5 to Westlock, a station on the Edmonton Dunvegan and British Columbia railway, about sixty miles north of Edmonton. This line was sixty-six miles along travelled roads, and took from December 9 to January 18.

The following table gives the lines of levels, of all classes, which were run in the twelve months ending March 31, 1916.—

Lines of levels run in season 1915.

Meridians and Base Lines.

Line.	Townships or Ranges.	Surveyor.	Miles.
8th base east of Principal meridian	7– 9	G. H. Blanchet	15
9th " " " "	6– 7	"	11
10th " " " "	4– 6	"	18
11th " west " "	10– 15	T. H. Plunkett	36
12th " " " "	11– 16	"	32
15th " " " "	4– 31	G. H. Herriot	164
East outline, range 3, east of Principal meridian	37	G. H. Blanchet	6
East " " 6, " "	33– 36	"	24
East " " 7, " "	29– 33	"	24
East " " 9, " "	27– 28	"	12
East " " 11, west "	41– 44	T. H. Plunkett	24
East " " 13, " "	45– 48	"	24
East " " 21, " "	57– 60	G. H. Herriot	24
9th base, west of Second meridian	1– 29	A. G. Stuart	169
9th " " Third "	1– 29	"	169
9th " " Fourth "	1– 29	"	169
Fourth meridian	54– 61	"	48
27th base, west of Fourth meridian	1– 25	F. V. Seibert	145
East outline, range 9, west of Fourth meridian	103–105	"	10
Fifth meridian	15– 32	A. G. Stuart	108
24th base., west of Fifth meridian	1– 17	J. A. Fletcher	102
25th " " "	1– 17	"	102
27th " " "	22– 25	J. R. Akins	16
Sixth meridian	91–126	"	216
30th base, west of Sixth meridian	1	"	3
Total			1,671

Subdivision of Townships.

Tp. 13-15-E; tp. 13-16-E; tp. 13-17-E, and tp. 14-15-E	W. A. Scott	92
Tp. 53-20-2; tps. 52 and 53-21-2, tps. 53 and 54-22-2; tp. 54-23-2, and tps. 53 and 54-24-2	W. Christie	260
Tp. 65-6-5; tps. 63, 64 and 65-7-5, and tps. 61 and 62-8-5	A. Lighthall	264
Tps. 82 and 87-19-5 and tp. 84-20-5	J. H. Johnston	238
Total		854

Precise Levels.

Line.	From	To	Route.	Surveyor.	Miles.
R	Portage la Prairie	Goodeve	Grand Trunk Pac. Ry	L. O. R. Dozois	247
S	Saskatoon	Rosebud	Can. Northern Ry.	E. W. Berry	339
T	Grouard	Dunvegan	Wagon road	L. E. S. Bolton	144
		Total			730

Miscellaneous Levels.

Westlock	Tp. 63-7-5	Wagon road	E. W. Berry	66
Pelly	Swan River	Can. Northern Ry.	L. O. R. Dozois	43
Miscellaneous short lines				72
Total				181
Total of all lines run during the year				3,436

In addition to the above, reconnaissance levels were carried out in the district near St. Paul de Metis and Cold lake, Alberta, as follows: Desjarlais ferry to Cold lake, 118 miles; Charlotte lake to Saskatchewan river, 40 miles; Beauregard lake to Vincent lake, 10 miles. Total, 168 miles.

Work in the Calgary office.

In addition to the general work of supervision of the levels which have been run directly by the Calgary office, steady progress has been made in examining and compiling the results of the levels carried out during the year by all the surveyors employed by the branch. The latter amount to 1,671 miles of meridian and base line levels and 854 miles of subdivision levels, and the former to 911 miles (not including 168 miles of approximate exploratory levels). This makes a total of 3,436 miles of levels in one season. This is a large mileage of new work to be dealt with.

The general nature of the work is the same as was outlined in last year's report, with the addition of new arrangements for recording the subdivision levels. In the case of these no lists of bench-marks or of elevations are prepared. Two separate plans are made of each township. One of these shows only the bench-marks, giving their positions, descriptions and elevations. It is intended entirely as an office record. The second contains the elevations of the natural features which are plotted on the plan, line by line. The lines are then gone over, and the positions of the contours, generally for every ten feet, are marked by interpolation. The contours are then sketched in over the whole township, and the elevations of corners and of the more important features added to the plan. The subdivision levels taken during the past year involve twenty-five townships.

The following is a summary of the work done in the Calgary office during the twelve months ending March 31, 1916:—

—	Meridian and Base Line Levels.	Precise Levels.	Subdivision Levels.	Other Levels.	Totals.
FIELD BOOKS.					
Received from the field, April 1, 1915 to March 31, 1916	118	61	38	9	226
Miles of levels recorded in these	2,550	837	743	242	4,372
Field books, entirely examined	102	42	25	9	178
Field books, partly examined	45	.....	.....	.....	45
BENCH-MARKS.					
Number of bench-marks compiled for the first time	3,582	515	333	.....	4,430
Number of miles in which they occur	3,547	837	400	.....	4,784
PROFILES.					
Number of sheets completed	90	.....	8	tp. sheets	98
Number of miles on same	2,851	.....	400	.....	3,251

(To accompany report of J. N. Wallace, D.L.S.)

REPORT OF E. W. BERRY, D.L.S.

I beg to submit the following report on lines of levels run by me during the season of 1915. My first work was a line of precise levels from Saskatoon towards Calgary, along the Canadian Northern railway.

This work was begun at Saskatoon on May 20, and by August 11 we had proceeded as far as Alsask, and connected with four bench-marks established by Mr. A. G. Stuart D.L.S., when he was retracing the Fourth meridian in 1914. This involved running five miles of levels along the meridian and diverted road. From there the precise level line was continued to Rosebud, where work on the main line was suspended on October 19. The distance from Saskatoon to Rosebud is 339 miles. In addition to this, thirty-seven miles of spur lines to various bench-marks off the right of way of the railway were run during the season. The distance form Saskatoon to Calgary is nearly 400 miles.

On October 20 the camp outfit was consigned to Calgary. The party, with the exception of the recorder and two rodmen were paid off, and I returned to Hanna to connect the precise level line with the levels run by Mr. A. G. Stuart, D.L.S., along the 9th base line this season. The connection was made along the most frequented trail northerly from Hanna. The length of this connection is twelve miles. In addition one mile of levels was run along the base line, so as to connect with two of Mr. Stuart's bench-marks. Having completed this work I returned to Tessier on November 4. Here a similar connection was made to five bench-marks of the 9th base line in range 11, west of the Third meridian. This was accomplished by running south from Tessier station along the east boundary of section 1, township 33, range 11, to the base line, and west along the base line, a distance of three miles. This being completed, I paid off the remaining men and returned to Calgary on Novembr 5.

As usual, the precise level line was divided into sections about one mile in length. Every section was levelled at least once in each direction, and the mean of the determined values of the several differences of elevation was adopted in computing levels. The amount of the accumulated discrepancy between the forward and backward lines at intervals of ten miles, with the corresponding mileage, is tabulated below:—

Miles from Saskatoon.	Discrepancy (ft.)	Miles from Saskatoon.	Discrepancy (ft.)
0	−0·000	180	−0·054
10	−0·002	190	−0·083
20	−0·016	200	−0·034
30	−0·014	210	−0·022
40	−0·019	220	−0·036
50	−0·004	230	−0·028
60	−0·032	240	−0·027
70	−0·037	250	−0·031
80	−0·033	260	−0·042
90	−0·031	270	−0·066
100	−0·063	280	−0·046
110	−0·075	290	−0·041
120	−0·129	300	−0·051
130	−0·063	310	−0·007
140	−0·067	320	−0·058
150	−0·069	330	−0·050
160	−0·046	339	−0·013
170	−0·078		

Permanent bench-marks on concrete pillars were erected at uniform distances of four miles apart as nearly as possible. The pillars are in the form of a frustum of a pyramid, twelve inches square in horizontal cross-section at the base, and eight inches

at the top. They are six feet in height, and rest on a concrete foundation five feet below the surface of the ground. The bench-mark point is on a brass plate sunk in the top of the pillar. No pillar was placed within a mile of any railway station. When pillars are placed near to stations there is danger of their being disturbed when buildings are erected later. Additional bench-marks on copper bolts were placed on suitable masonry structures where these occurred. The work of making bench-marks was done by two men who travelled in advance of the party. Bench-marks were completed along the whole line from Saskatoon to Calgary. Between Saskatoon and Rosebud there are one hundred and forty permanent bench-marks. Of these, fifty-three are copper bolts in the masonry of buildings or bridges and eighty-seven are brass-plates on the standard concrete pillars. Between Rosebud and Calgary there are twenty bench-marks on masonry structures and fifteen on concrete pillars. In all one hundred and seventy-five bench-marks were made during the season.

The elevations of the railway grade opposite all railway stations were recorded, also of the top of rail at the crossing of all roads of the Dominion Lands system of survey between Saskatoon and Red Deer river, with the exception of a few roads which have been closed for some reason. West of Red Deer river the land is hilly and broken by numerous ravines. East of Rosebud, very few roads have been opened across the railway, as the land which belonged to the Canadian Pacific Railway company has been resurveyed into blocks of irregular shape following the contours of the ground. Eighty-three elevations of water level in lakes and streams along the line were also obtained.

The elevation of the base of rail opposite the Canadian Northern railway station at Saskatoon is 1,590 feet above mean sea-level. Rosetown with an elevation of 1,926 feet is 336 feet higher. It is seventy-one miles distant from Saskatoon along the railway. Leaving Rosetown the ascent of Bad hills commences, and the summit is reached at D'Arcy at an elevation of 2,285 feet. This is 360 feet above Rosetown and twenty-six miles west of the latter place. From here to Kindersley where the elevation is 2,231 feet, there is a gradual descent of fifty-four feet. Westerly from Kindersley, the railway rises gradually, crossing some minor summits and depressions to Hanna. The elevation of Hanna is 2,679 feet or 448 feet above Kindersley. From Hanna the line follows the valley of Bullpound creek to its headwaters near Delia in Hand hills. The base of rail at Delia station is 294 feet above Hanna and 2,973 feet above mean sea-level. This is the highest railway station between Saskatoon and Red Deer river. The first water draining southwest to Red Deer river is Mecheche creek. The descent from Delia to the water of Red Deer river is 744 feet in a distance of twenty-eight miles. The elevation of this river is 2,229 feet. After crossing Red Deer river, the railway follows its course to the confluence of Rosebud river at Rosedale, four miles southeast of Drumheller. Thence it ascends the valley of Rosebud river. The rise from Red Deer river to Rosebud station is 356 feet in a distance of twenty-five miles. The elevation of the railway grade at Rosebud is 2,585 feet.

There were an exceptional number of rainy days during the early part of the season. Apart from this, the weather conditions were about normal. The chief difficulties with which we had to contend were the unsteadiness of the atmosphere and the almost incessant high winds which are familiar to every one who has done precise instrument work in the prairie provinces.

From November 5 to December 8 I was engaged in preparing the returns of the precise level line from Saskatoon to Rosebud and on other office work. My next work was a line of levels to provide a datum for the levels run during 1915 by Mr. A. Lighthall, D.L.S., in subdividing townships 61 and 62, range 8, townships 63, 64 and 65, range 7, and township 65, range 6, all west of the Fifth meridian.

This line was commenced at the SE. cor. sec. 3, tp. 63-7-5. From there the levels were carried down Freemen river for several miles, then along a Provincial Government road to the E. By. sec. 28, tp. 60-4-5, and thence along section road allowances to

Westlock, where we connected with the Edmonton Dunvegan and British Columbia railway. The length of this line is sixty-six miles. The work was commenced on December 18, and was completed on January 17.

The degree of precision required for this work was the same as for levels on base lines, viz. 0.10 feet discrepancy per mile section. The line was divided into sections about one mile in length and each section was levelled forward and checked in the opposite direction. Each section begins and ends on a bench-mark. These were spikes in growing trees or in telephone poles. Seventy-two bench-marks were established in all. The elevation of the ground at corner monuments and other points which can be identified on the ground and published on the map, were determined in connection with the work. Of these there are eighty-five. The water level of streams and rivers was also taken at thirteen definite points. In addition to furnishing a datum for the levels of Mr. Lighthall's surveys, this line affords a good line of levels, believed to be of sufficient accuracy for any practical purpose except the extension of the precise level network. It runs through a district already almost completely occupied by settlers, and in which engineering problems in connection with highways, railways, and drainage will have to be solved at no very distant date.

Freemen river is a small and rapid stream in a narrow valley whose rim is one hundred feet above the water. At some places along the course of the river the ground rises in tiers of benches, and the edge of the valley is over a mile from the river; at others, a cut bank rises sheer from the water's edge. The elevation of the water of Freemen river at the south boundary of township 63, range 7, is 2,270 feet above mean sea-level. Two miles south and about one and a half miles east of this point, the river crosses the north boundary of section 24, township 62. Here its elevation is 2,200 feet. This gives a fall of seventy feet in a distance of about three and a half miles along the winding course of the river. The elevation of Athabaska river at Holmes Crossing is 1,968 feet. On the south side of Athabaska river, there is a flat about three-quarters of a mile wide. The road follows this for four miles, and then commences the steep ascent from Athabaska valley. The highest point is reached near the intersection of the road with the east boundary of section 23, township 61, range 5, where the elevation is 2,319 feet, being 351 feet above the water level of Athabaska river. At the end of the provincial road in section 28, township 60, the elevation is 2,201 feet. Opposite the Lutheran church near the northeast corner of section 16, township 60, range 3, there is a minor summit of 2,290 feet. At Barrhead post office the elevation is 2,222 feet. The water level of Pembina river at Rossington ferry is 2,029. This is sixty-one feet higher than Athabaska river at Holmes Crossing. The grade of the Edmonton Dunvegan and British Columbia railway at Westlock station is 2,127 feet above mean sea-level.

The weather was comparatively mild until Christmas, but after that the cold became severe, the temperature ranging from 0° to —50°. There were, however, no heavy snowstorms, so that the work proceeded without interruption. The work was finished at Westlock on January 18.

(To accompany report of J. N. Wallace, D.L.S.)

REPORT OF L. E. S. BOLTON, D.L.S.

Line of levels from Grouard to Peace River and Dunvegan.

Previous to this season a line of levels had been run from Edmonton to Athabaska and thence up Athabaska and Lesser Slave rivers to the water of Lesser Slave lake. My work this season consisted in continuing this line of levels farther west. The water of Lesser Slave lake was utilized to transfer the elevation from the east end of the lake at Sawridge to the west end at Grouard. This was done by reference to the readings of the gauges placed at each end of the lake by the Commissioner of Irrigation.

The line of levels from Grouard to Peace River Crossing was commenced on June 23, along the travelled highway. This road runs across clay land which is never dry, except on the surface, and this caused difficulty in getting stable turning points. The first fifty miles, to the junction of the trail from Reno, had been travelled very little this year so that it was not much cut up but it is the wettest portion of the trail, and there progress was slow. The deep mud made walking difficult and there was some rainy weather which kept the road wet, although it caused us to stay in camp for only two and a half days. After passing the junction of the trail form Reno, there was no wet weather.

Only one rodman was employed. Using two rodmen would have eliminated the error due to the settling of the instrument, but on a road with as hard a surface as this, except after a rainy spell, the error caused by the settling of the instrument is much smaller than that caused by the settling of the hub. The best turning point was obtained by driving the hub into a corduroy log which was entirely beneath the surface of the road. From Peace River Crossing to Dunvegan the bed of the road contains a larger percentage of sand and gravel and in this portion very little difficulty was experienced from sinking of the hubs. On the contrary, the hub, when driven firmly into the ground in the sand and gravel road, frequently rose up, so that it was found better to place them off the trail altogether. The traffic here did not interfere with the work, as we did not follow the surveyed trail but the road to the south which follows section lines and will eventually be the travelled road.

It was difficult to avoid inequality in the lengths of the back-sights and fore-sights. It is not possible to keep these individually equal unless a great deal more time be taken. The only thing that can be done is to arrange that the accumulated lengths shall be equal over each division.

The permanent bench-marks established consisted of iron pipes four feet long and two and a half inches in diameter, with a plate seven inches in diameter screwed to the foot. On the top end a brass cap is riveted on which is marked "TOPOGRAPHICAL SURVEYS, LEVELS, B.M." and the number. These were planted every four miles, on section lines wherever possible, and back from the road where they would be least likely to be moved by grading outfits or by settlers when ploughing their land. The only other permanent bench-mark established was one copper plug. This was placed in the sandstone cliff at Peace River Crossing on the west side of the river.

To make the connections across Lesser Slave lake I utilized the gauges established by the Commissioner of Irrigation at Grouard and at Sawridge. For this purpose the mean of the readings from September 1 to October 15, at each gauge was taken. The mean of each gauge would give the mean elevation at that end of the lake, during a time which included both east and west storms and normal conditions. It is therefore reasonable to assume that the mean at one end is the same absolute elevation as the mean at the other end. At Grouard the rod was held directly on the eight-foot mark on the gauge, so that the zero of the gauge was obtained directly. At Sawridge the work was a little more complicated, as the gauge is on Dog island, about two miles out in the lake. A temporary gauge was placed in the lake behind a small point of land half a mile from the source of Lesser Slave river so as to be away from any local effect due to the lake emptying into the river. An arrangement was then made with the observer of the gauge at Dog island whereby he read the gauge in the evening when the lake was most nearly calm, and fired two shots as a signal at the time. I then read the temporary gauge. As the rise and fall of the water at the temporary gauge was only 0·05 feet at the time of reading, the result is more accurate than would have been gained by attempting to take a sight with the level across the two miles of water.

The allowable closing error was 0.017 feet $\sqrt{}$ distance in miles. It was necessary to do a considerable amount of rerunning to get the levels to check within this limit and, as the ground was very soft, the hub was always sinking so that the error was accumulative. At the end of sixty miles, the total discrepancy was -0·178 feet, which

is equivalent to an error of 0.023 feet $\sqrt{}$ distance in miles, and at ninety miles it was —0.234 feet, which is equivalent to an error of 0.024 feet $\sqrt{}$ distance in miles. The closing errors then became positive and the total discrepancy decreased. To avoid so much rerunning it was considered advisable to increase the allowable error to 0·030 feet for an individual mile section. This resulted in much less rerunning. When the line reached Dunvegan, at the end of 144 miles, the total discrepancy was -0·109 feet which is equivalent to an error of 0.009 feet $\sqrt{}$ distance in miles.

When crossing the 21st base line on the road from Grouard to Peace River Crossing, a connection was made with the bench-mark established by Mr. A. H. Hawkins, D.L.S., during the season 1910. This bench-mark was two miles from the trail, and it was necessary to employ the teamster to open up the line.

Connection was also made with the bench-mark established by Mr. J. H. Johnston, D.L.S., from which he ran levels northerly to the 22nd base line in connection with the levels of his subdivision work.

A spur line was run to lake Cardinal. There was no available trail, but the country was fairly open, so that no difficulty was experienced in making the connection. When crossing the Sixth meridian, two permanent bench-marks were established. After completing the line to Dunvegan we came back and started from these bench-marks to go up the Sixth meridian, to the bench-mark established by Mr. J. R. Akins, D.L.S., during the season of 1912, at the southerly end of the meridian levels in township 84. As the line was filled with second-growth willow and poplar, I went east to the trail leading to Last lake and used it. This made the distance twenty-four miles. From Last lake the line had been partly opened up by Mr. R. V. Heathcott, D.L.S., during the present season. The remainder, some four miles, I had to have cut out. For this purpose I engaged a man in the vicinity.

The elevations of all streams, and of the ground at the crossings of all section lines, were recorded. When crossing a section line the elevation of the ground was taken at a section or quarter-section post unless the post was some distance from the trail, in which case the elevation of the centre of the road was taken.

From Grouard to Peace River Crossing the country was generally rolling with a few hills near the summit of the divide. West of Peace River Crossing the country is undulating with no pronounced hills.

From Grouard around Buffalo bay the trail goes through a low flat for twelve miles, and then rises 400 feet in the next four miles. The elevation in section 6, township 77, range 15, is 2,336 feet. This is the summit of the divide between Lesser Slave lake and South Heart river. The elevation at South Heart river, twenty-three miles from Grouard, is 2,046 feet. The line then rises for nine miles until, in section 32, township 78, range 17, the elevation is 2,300 feet. It then falls to Bearhead creek in section 25, township 79, range 18, which has an elevation of 2,181 feet. This is thirty-eight miles from Grouard or halfway to Peace River Crossing. From Bearhead creek it rises for six miles, until in section 15, township 80, range 18, the elevation is 2,314 feet, and then falls to an elevation of 1,922 feet at North Heart river, which is fifty-six miles from Grouard. It then falls about thirty feet to the mile until the top of Peace river valley is reached. The east bank of the valley is about 700 feet above the river, the elevations of the top of the valley and of the water of the river being 1,720 feet and 1,025 feet, respectively.

After crossing the river the trail runs for twenty miles along the western side, keeping in the low land, about fifty feet above the river. Hence it is nearly level, except for three hills one hundred feet high where the trail goes up and around a cut bank. Where the trail leaves the river the bank is 800 feet high. The elevation at the top is 1,849 feet. Then the country is nearly level, rising only about twenty feet per mile to a point three miles west of the Sixth meridian where the elevation is 2,183 feet. From there north the country is nearly level. Lake Cardinal, six miles north, has an elevation of 2,124 feet.

From there the country falls steadily to the top of the hill at Dunvegan, the elevation of which is 1,767 feet. The elevation of the water in Peace river is 1,091 feet, which is sixty-six feet higher than at the town of Peace River Crossing.

In making the connection with the levels on the Sixth meridian the trail goes through level country as far as Last lake, which has an elevation of 2,132 feet. From Last lake, going north, the meridian passes over rising ground reaching an elevation of 2,171 feet at the north of township 84, where I connected my levels to the levels previously run north from that point.

In all 176 miles of levels were run as follows:—

	Miles.
From Grouard to Dunvegan	144
To connect with 21st base line	2
To connect with lake Cardinal	6
To connect with Sixth meridian	24
Total	176

Work was begun at Grouard on June 23 and finished on September 24. The party arrived at Edmonton on October 1. After arranging for storage at Edmonton, I went back to Sawridge and connected the bench-marks there with the water-gauge as previously explained. I returned to Calgary on October 8.

(To Accompany Report of J. N. Wallace, D.L.S.)

REPORT OF L. O. R. DOZOIS, D.L.S.

From April 30 to May 8, I was engaged in retracing a portion of the precise level line run the previous season from Winnipeg to Swan River. The line was relevelled from the initial bench-mark on Fort Garry Union station to bench-mark 4, on the railway near the limits of the city. A spur line was also run from Fort Garry Union station to the Canadian Pacific Railway station at St. Boniface; a connection with their datum at this point was desired for purposes of comparison between our levels and railway levels.

In doing this work it was necessary, in places, to follow the main streets, and so the work had to be done in the early morning before the daily traffic had begun.

The party was composed of a recorder, two rodmen, an umbrella man, a cook, and a hand-car pilot, the latter being appointed by the Grand Trunk Pacific Railway Co., while his wages were to be paid by us.

The levels along the track of the Grand Trunk Pacific railway westerly from Portage la Prairie were begun on May 10. The datum used was derived from the two bench-marks established the previous year on the armoury and court house respectively. These elevations had been listed on the latest revised sea-level datum.

For the first 125 miles, as far as Miniota, the wind was a serious drawback to the progress of the work. This was particularly the case while working through the flat table-land known as the Portage plains. This wind-swept territory may be said to extend about sixty miles west of Portage la Prairie.

During the early part of May, just following seed-time, the sandy soil is lifted by the wind and formed into clouds which fill the atmosphere with dust. On one occasion the wind was sufficiently strong to force a freight car out on the main line by springing the switch, and to then drive it a couple of miles down the track. Beyond Portage plains as far as Miniota the country becomes more rolling, with occasional wooded bluffs, which afford some respite from the wind.

At Miniota the railroad descends into a valley of Assiniboine river, through which it winds for twenty-five miles as far as Lazare. Qu'Appelle river joins with

the Assiniboine just west of Lazare station. The railway crosses the Assiniboine there, and entering Qu'Appelle valley, it ascends sharply for twelve miles, returning to the uplands at Welby station, near the Saskatchewan-Manitoba boundary.

Along the forty miles of track that lie in the Assiniboine and Qu'Appelle river valleys the levelling proceeded much more satisfactorily, due to the complete absence of wind. By this time, however, the July heat had arrived and the radiation of heat from the earth's surface was having a disturbing effect on the accuracy of the readings. The result was shown in more cases of third levelling being required, and a correspondingly fewer number of small closings for a mile section.

It became apparent at this stage of the season that really good levelling conditions would never occur so long as work was carried on during the three or four hours preceding and following mid-day. On a hot day in July or August, with a clear sky, the air begins to wave at about 8.30 a.m., and gradually becomes more disturbed until noon, when the rod cannot even be read to the nearest hundredth of a yard with any confidence. It remains in this disturbed condition until about 3.30 p.m., when it begins to subside, and has usually returned to a tranquil state at about 5 p.m.

It has been found that a light wind has a modifying influence on "shaky" air, and for this reason the state of the air will vary from day to day. Generally speaking, however, I am of the opinion that precise levelling cannot be efficiently carried on in the prairie provinces during, approximately, eight hours of the day, four hours in the forenoon and four hours in the afternoon. This statement does not apply to cloudy days, providing the weather is not sultry.

The only remedy that presented itself was a complete change in the working schedule. Heretofore the daily working hours had been from 7 a.m. until 6 p.m. It was decided to utilize the hours following sunrise and preceding sunset, and accordingly, on July 7, the new schedule was put into effect. We were at this time in the Assiniboine valley. Work was started at 5 a.m. and continued as long as the air remained steady. As soon as the air showed signs of "shakiness" work was adjourned and the party returned to camp. This hour would necessarily vary with the month of the year. In July the air will first show signs of unsteadiness, when the sky is clear, between 8.00 and 8.30 a.m. At about 4.30 p.m. we were back at our posts, the instrument set up and the rodman in position, ready to begin work when the air permitted. The state of the air was observed every five minutes, and when it had sufficiently subsided, work was resumed. The hour at which the air will return to its normal state could not be determined definitely as this hour was observed to vary greatly, being influenced by the temperature, moisture, wind, etc. On some clear days we were able to resume work at 4.30 p.m., while on others the air would be unsteady until 6.30 p.m. Work would be stopped between 8 and 9 p.m.

When the sun is low, as it was under this new time schedule, there is a pronounced difference in illumination of the forward and backward rods when running parallel with the rays of the sun. This might give rise to an accumulative error, though hidden, if not counteracted by a proper adjustment of the field work. The only safe way is to leave the early morning work to be checked in the opposite direction in the evening. In this way any small error of illumination is bound to appear when the forward and backward values are compared. The mean of the two values will be unaffected by the error. Local mean time should be used instead of standard time.

The new schedule showed such a marked improvement that it remained in force until the end of the season. The hours had to be adjusted as the summer wore on. The impression should not be gathered that the new schedule was less strenuous on the members of the party than the old one, although the day's work was only five and sometimes six hours long instead of ten hours. The new schedule had not been in force two weeks before any member of the party would gladly have returned to the ten hour day. This was notably so in the case of the cook, who was required to serve breakfast at 4.30 a.m. and dinner at 9 and 9.30 p.m. However, the change of schedule

was a success considering the results attained. The bad effects of the disturbed air were not only avoided, but the evil influences of the wind were no longer a daily occurrence.

The daily action of the wind on the prairie may be described as very similar to the heat waves, that is to say, it comes on gradually, first as a breeze shortly after sunrise, and grows in volume as the sun gets higher. Almost invariably, the wind will abate a little before sunset and drop entirely as the sun goes down..

From Portage la Prairie the railway rises steadily from an elevation of 858 feet to an altitude of 1,647 feet at Oakner, 100 miles farther west. From there to the beginning of the descent into the Assiniboine valley the grade shows a drop of 150 feet in twenty miles, and in the next fourteen miles it drops 220 feet to the bottom of the valley, resulting in an elevation of 1,277 feet for Treat station. The railway crosses Assiniboine river at a grade level of 1,302 feet, and rises 300 feet in the next twelve miles, attaining an altitude of 1,602 feet at Welby station. From Welby to Goodeve, which is as far west as the levels were carried, there is a constant rise, an altitude of 2,102 feet being reached at Goodeve.

For the first twenty miles the accumulated discrepancy between the forward and backward lines fluctuated on either side of the zero mark, that is to say, it was positive for a couple of miles, then negative and vice versa. After twenty miles it became negative and remained so for 225 miles to the end of the season, when it had amounted to 0.079 feet. The greatest accumulated discrepancy was 0.141 feet at mile 235 from the beginning.

In all, 267 sections were run, the average length of a section being 0.9 miles. Of these only twenty-seven sections have a discrepancy exceeding 0.010 feet. This amounts to ten per cent, as compared with twenty-five per cent on last season's work. The positive and negative discrepancies were about equal in number. The probable error of the mean of a mile section is 0.002 feet, and the probable error of the whole line of 247 miles is 0.0345 feet.

The only streams of any note crossed by the Grand Trunk Pacific railway, from Portage la Prairie westerly, are Minnedosa, Oak, Arrow, Assiniboine, and Cutarm rivers. Besides these there are five or six creeks, some of which are dry in summer. The elevation of the water was recorded in all streams crossed by the line of levels.

From Gerald to Goodeve, a distance of sixty-seven miles, there is a serious scarcity of water in the immediate vicinity of the railway. There were no lakes on either side of the railway of sufficient importance to justify the running of branch lines of levels.

Along this line of levels fifty-nine permanent bench-marks were established. These may be classified as follows in the order of their value as to permanency: concrete pillars, twenty-nine; bridge piers, two; churches and schools, five; water tanks, seven; elevators, five; dwelling houses, seven; hotels, one; railway semaphore stands, one; stations, one. A permanent record of the elevations was thus left on the ground at intervals averaging 4.2 miles. Apart from these, 232 temporary bench-marks were established by spikes driven horizontally into telegraph poles.

Tests carried out on other lines, by this office, have shown that there are comparatively few cases where these temporary bench-marks become disturbed by more than a tenth of a foot in a couple of years.

A connection was made with the line of levels run by Mr. A. G. Stuart, D.L.S., along the east boundary of range 31, west of the Principal meridian. The connection was made by means of a spur line from about midway between Welby and Spyhill stations. Two of Mr. Stuart's bench-marks established at the westerly end of the 6th base were also tied in with the precise level line by a spur run northerly along the Second meridian from the railway.

These two connections were about twenty-eight miles apart reckoned along the route followed by Mr. Stuart's levels. His levels for this distance agree very closely

with our precise levels along the railway, the disagreement being only 0·02 feet in the twenty-eight miles.

A connection was also made with the level datum of Melville, Sask. Work was discontinued on August 28, a total distance of 247 miles having been levelled in the period from May 8 to August 28. This is an average rate of 67⅓ miles per month. Work was stopped at this early date, as it was desired that I should run a line from Pelly to Swan river over the Canadian Northern railway, for the purpose of connecting Mr. Stuart's levels on the 9th base to the main line of precise levels from Winnipeg to Edmonton.

These levels were begun at the eastern extremity of the 9th base and carried 4¼ miles north along the Second meridian to the railway. The meridian crosses this branch of the Canadian Northern railway (known as the Thunderhill branch) at a point four miles west of Pelly station. The elevation of the Second meridian at the crossing is 1,454.1 feet, while sixty miles farther south, where it crosses the Grand Trunk Pacific railway, the elevation is 1,717 feet.

It was not intended that this line should be run with the usual precision governing levels along the railway. The primary object, in this case, was to obtain a comparison of datums between the levels run on the 9th base and those along the railway through Swan River. To avoid any third levelling the allowable closing per mile section was increased to 0.30 feet. Permanent bench-marks were established wherever suitable structures were available. No concrete pillars were made on this line. The total distance levelled was forty-three miles. This was completed in the period from September 2 to the 14th. Three permenent bench-marks were established as well as thirty-nine temporary bench-marks. The elevations of eight streams and of the base of rail at five railway stations were recorded. Road crossings were also recorded at about every two miles.

The party was disbanded on September 15, and I left for Calgary the same day, arriving there on the morning of the 20th, being delayed one day at Melville in connection with the storage of my outfit.

From September 30 to November 30, I was engaged in running approximate lines of levels through the country covered by the Saddle Lake sectional map. This is a district near St. Paul de Metis and Cold lake, Alberta. A total of 168 miles were levelled and the elevations of thirty-six lakes, twelve streams and one hundred and two land points were recorded. On my return to Calgary I was engaged in making up part of my returns till December 15, when I went east, returning to Calgary on February 15, 1916.

I left Calgary for Prince Albert on February 27 in order to run a connection between Candle lake and Mr. Christie's subdivision levels. The levels were begun from Candle lake and carried across Torch lake, and then southerly to the subdivision, following a very winding bush trail about eight miles in length. This work was completed on the evening of March 9. A double line was run.

The snow was still over two feet deep in the bush and the temperature well below freezing except near midday when it was comparatively mild and springlike.

The return trip to Prince Albert was completed at noon March 10, and I left at once for Calgary, arriving there on the afternoon of the 11th.

APPENDIX No. 71.

ABSTRACT OF THE REPORT OF W. E. WELD, D.L.S.,

SUBDIVISION SURVEYS NEAR GRAND RAPIDS, MANITOBA.

We reached Grand Rapids on September 3, and began the season's work by subdividing tp. 48-13-Pr. After finishing work in the eastern part we moved across the township on the Hudson's Bay Company's tramway.

It is narrow gauge with a very light iron rail, and save as a convenience for the few travellers, it is little used, and is falling into disrepair. The company owns a large lot at the east end of the tramway and another of about nine acres in extent at the west end. On the latter are the remains of a large frame freight shed, into which the tramway runs, a large log residence, and a frame warehouse. About one-half mile down stream from this lot, there is another Hudson's Bay company's lot about forty acres in area.

From the up-stream end of the portage the subdivision was continued.

The cutting was heavy almost throughout, the slowest progress being made through the dense second growth of jack pine which grew through the tangled mass of fire-killed trees lying around in certain sections. On leaving the muskeg adjoining the settlement and travelling west, one does not meet with any water whatever in the township or in the tier of sections of the township adjoining, and this lack of water will be a great handicap and will retard settlement in the township.

On September 24, the subdivision being almost completed, work was commenced on the river traverse. The low banks and willow found in places, rendered it impracticable to adopt the stadia method, and owing to the current short distances only could be chained across the water, particularly in the rapids where it was not safe to let the chain enter the water; on account of this the courses had to be cut out and were necessarily short. Much greater care than is usually adopted in such traverses was taken, owing to the great water-power possibilities, and all the information possible regarding the banks was obtained.

Camp was moved back across the tramway on September 30, and the remainder of the week devoted to retracing the Indian Reserve boundary and continuing the river traverse. On October 4, the survey of the additional lots at the settlement of Grand Rapids was commenced. This work, together with the completing of the traverse of the Indian reserve and river, the traverse of the bay and overflow channel, the road across the Hudson's Bay company's lot, and mounding and marking posts, kept the entire party busy.

Fortunately everything was completed on October 16, just giving time to strike camp and embark on the steamer "Wolverine" which left Grand Rapids for Selkirk on the following day. Winnipeg was reached on the 19th and the final work of the survey completed there on the 21st.

The soil in tp. 48-13-Pr. varies considerably, sections 13, 14, 15, 27, and 34 being largely spruce muskeg, dry on the surface and wet underneath. In some cases, it was found to be frozen solid a foot or so beneath the surface. Elsewhere, under a varying thickness of loam mixed with humus we found clay, mixed sometimes with sand or gravel, and usually interspersed with limestone boulders of varying size. A layer of stone an inch or two thick was frequently found above the clay. In general, the soil is not promising from an agricultural aspect, although sufficient crops for local consumption could be raised. Summer frosts too are of frequent occurrence.

This township has suffered severely from fires, particularly along the tramway and the river, and except for occasional patches of good spruce, tamarack and jack pine, the township is in the main covered with a dense second growth of no commercial value. In the four sections surveyed in tp. 48-14-Pr. some very good stands of jack pine and spruce up to twelve or eighteen inches in diameter were found, and there are indicatios that this extends farther into that township.

As has already been pointed out, the lack of water would prove a serious hindrance to the development of the district. The development of the water-power or the extension of the railway from Gypsumville would undoubtedly help the district, but both of these are somewhat improbable at the present, and no great stride in the development of Grand Rapids can be expected in the immediate future.

The weather was in the main good, with heavy frosts and several snowfalls throughout September. The black flies, however, remained in great numbers until the close of the survey.

APPENDIX No. 72.

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.

Table 1.—Declination Observations.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
21·84 E.-NE. cor. sec. 32	88	1	E. 2 E.	Dec. 24, '14	9 22	G. H. Herriot.
0·60 E.- " 33	88	1	"	" 26, '14	08	"
58·03 E.- " 35	92	2	"	" 19, '14	6 39	B. W. Waugh.
58·03 E.- " 35	92	2	"	" 19, '14	38	"
34·75 E.- " 32	88	4	"	Jan. 12, '15	58	G. H. Herriot.
22·52 E.- " 33	88	4	"	" 13, '15	18	"
39·07 E.-NW. " 31	88	5	"	" 15, '15	7 37	"
33·71 E.-NE. " 31	88	5	"	" 16, '15	8 02	"
56·26 E.- " 33	88	5	"	" 18, '15	01	"
6·31 E.- " 34	88	5	"	" 19, '15	05	"
6·90 E.- " 33	92	6	"	" 5, '15	6 09	B. W. Waugh.
6·90 E.- " 33	92	6	"	" 5, '15	11	"
28·25 E.- " 32	88	8	"	Feb. 1, '15	25	G. H. Herriot.
28·25 E.- " 32	88	8	"	" 1, '15	25	"
28·25 E.- " 32	88	8	"	" 1, '15	25	"
62·68 E.- " 33	88	8	"	" 2, '15	4 46	"
62·68 E.- " 33	88	8	"	" 2, '15	46	"
44·79 E.- " 34	88	8	"	" 3, '15	5 18	"
44·79 E.- " 34	88	8	"	" 3, '15	17	"
6·95 E.-NW. " 31	88	9	"	" 5, '15	40	"
34·20 E.-NE. " 31	88	9	"	" 6, '15	23	"
22·54 E.- " 32	88	9	"	" 8, '15	31	"
22·54 E.- " 32	88	9	"	" 8, '15	23	"
65·00 E.- " 33	88	9	"	" 9, '15	6 04	"
65·00 E.- " 33	88	9	"	" 9, '15	5 58	"
28·26 E.- " 33	88	10	"	" 13, '15	5 24	"
28·26 E.- " 33	88	10	"	" 13, '15	19	"
1·28 S.- " 1	91	11	"	Mar. 11, '15	4 47	"
1·28 S. " 1	91	11	"	" 11, '15	47	"
B.M. S.- " 36	37	3	E. Pr.	May 18, '15	12 17	G. H. Blanchet.
55·6 S.- " 13	37	3	"	" 22, '15	15	"
21·86 E.- " 31	72	3	"	July 10, '14	16 42	G. H. Herriot.
21·86 E.- " 31	72	3	"	" 10, '14	39	"
42·00 E.- " 32	72	3	"	" 13, '14	21 39	"
42·00 E.- " 32	72	3	"	" 13, '14	35	"
37·35 E.- " 35	72	3	"	" 14, '14	15 28	"
37·35 E.- " 35	72	3	"	" 14, '14	31	"
47·00 E.- " 31	36	4	"	May 26, '15	12 55	G. H. Blanchet.
34·67 E.-NW. " 31	72	4	"	July 15, '14	15 44	G. H. Herriot.
34·67 E.- " 31	72	4	"	" 15, '14	49	"
49·35 E.-NE. " 32	72	4	"	" 17, '14	10	"
49·35 E.- " 32	72	4	"	" 17, '14	18	"
42·91 E.- " 34	72	4	"	" 20, '14	16 36	"
42·91 E.- " 34	72	4	"	" 20, '14	40	"
At " 35	25	5	"	Mar. 12, '15	11 34	W. J. Deans.
At " 35	25	5	"	" 13, '15	12 06	"
27·00 W.- " 33	28	5	"	July 30, '15	12	R. B. McKay.
54·00 E.- " 34	36	5	"	June 5, '15	11 48	G. H. Blanchet.
58·90 E.- " 33	72	5	"	July 27, '14	15 26	G. H. Herriot.
58·90 E.- " 33	72	5	"	" 27, '14	29	"
8·00 E.- " 36	32	6	"	" 13, '15	11 11	G. H. Blanchet.
73·00 S.- " 36	33	6	"	" 2, '15	18	"
73·00 S.- " 13	33	6	"	" 5, '15	12 21	"
65·00 S.- " 36	34	6	"	June 26, '15	01	"
9·00 S.- " 36	35	6	"	" 21, '15	11 52	"
38·00 E.- " 31	36	6	"	" 8, '15	32	"

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
35·00 E.- NE. cor. sec. 34	36	6	E. Pr.	June 11, '15	11 15	G. H. Blanchet.
48·00 S.- " 36	36	6	"	" 14, '15	10 35	"
At " 36	16	7	"	" 27, '15	12 37	R. B. McKay.
At ¼ sec. cor. E. by sec. 36	16	7	"	" 28, '15	37	"
At NE. " sec 36	16	7	"	July 6, '15	24	"
78·00 S.- " 13	30	7	"	" 31, '15	11 59	G. H. Blanchet.
63·00 S.- " 24	31	7	"	" 26, '15	42	"
3·80 W. " 34	12	9	"	May 4, '15	56	C. F. Aylsworth.
20·00 N.-¼ sec. cor- E by sec. 30	21	9	"	Oct. 12, '14	21	W. J. Deans.
20·00 N. " " 30	21	9	"	" 13, '14	12	"
20·00 N. " " 30	21	9	"	" 15, '14	09	"
40·00 S.-NE. cor. sec. 4	25	9	"	" 17, '14	21	"
0·46 N. " 36	25	9	"	Aug. 16, '15	16	R. B. McKay.
60·00 S.- " 36	27	9	"	" 27, '15	12 04	G. H. Blanchet.
63·00 S.- " 25	27	9	"	" 28, '15	11 07	"
44·00 S.- " 13	27	9	"	" 30, '15	10 50	"
40·00 S.- " 10	4	10	"	June 6, '15	58	C. M. Walker.
At " 31	12	10	"	May 10, '15	13 14	C. F. Aylsworth.
41·00 E.- " 33	12	10	"	" 11, '15	11 45	"
15·50 S.- " 32	12	10	"	" 12, '15	18	"
31·00 S.- " 28	12	10	"	" 13, '15	9 57	"
22·50 N.- " 21	12	10	"	" 14, '15	10 45	"
11·00 W.- " 29	12	10	"	" 15, '15	11 33	"
15·00 S.- " 34	12	10	"	" 17, '15	11 06	"
26·00 W.- " 21	12	10	"	" 18, '15	10 03	"
6·70 W.- " 16	12	10	"	" 19, '15	9 02	"
63·70 N.- " 2	12	10	"	" 21, '15	10 21	"
69·75 E.-NW. " 31	80	10	"	July 4, '14	11 37	B. W. Waugh.
21·33 E.-NE. " 33	80	10	"	" 9, '14	10 28	"
21·24 E.-NW. " 31	80	11	"	" 13, '14	12 49	"
47·27 N.-NE. " 13	81	11	"	" 23, '14	11 45	"
56·68 N.-NE. " 13	82	11	"	" 31, '14	18 38	"
73·75 N.-NE. " 25	82	11	"	Aug. 1, '14	13 45	"
73·75 N.-NE. " 25	82	11	"	" 2, '14	40	"
30·28 N.-SE. " 1	83	11	"	" 4, '14	15 31	"
64·46 N.-NE. " 12	83	11	"	" 7, '14	14 11	"
30·12 N.- " 24	83	11	"	" 10, '14	25	"
76·74 N.- " 1	84	11	"	" 12, '14	13 34	"
24·88 N.- " 25	84	11	"	" 14, '14	30	"
40·00 W.- " 6	3	12	"	May 21, '15	10 54	C. M. Walker.
40·00 W.- " 6	3	12	"	" 23, '15	53	"
73·46 E.- " 33	80	12	"	Aug. 11, '14	9 53	G. H. Herriot.
73·46 E.- " 33	80	12	"	" 11, '14	59	"
19·38 E.-NW. " 31	84	12	"	" 18, '14	12 19	B. W. Waugh.
80·52 E.-NE. " 33	84	12	"	" 20, '14	15 20	"
15·64 E.-NW. " 31	84	13	"	" 21, '14	10 13	"
28·33 E.-NE. " 31	84	13	"	" 22, '14	11 10	"
79·37 E.- " 31	84	13	"	" 24, '14	12 05	"
61·11 E.- " 35	84	13	"	" 26, '14	14 48	"
52·91 E.- " 34	84	14	"	" 29, '14	8 57	"
9·88 N.- " 14	14	15	"	" 2, '15	10 28	W. A. Scott.
70·00 N.- " 10	14	15	"	" 3, '15	42	"
30·00 N.- " 17	14	15	"	" 18, '15	9 34	"
36·30 E.-NW. " 31	84	15	"	Sept. 3, '14	7 41	B. W. Waugh.
26·27 E.-NE. " 33	84	15	"	" 5, '14	9 42	"
63·71 E.- " 34	84	15	"	" 7, '14	8 51	"
61·25 E.- " 35	84	15	"	" 8, '14	51	"
14·75 N.- " 24	13	16	"	" 3, '15	12	W. A. Scott.
39·00 N.-SE. " 3	13	16	"	" 22, '15	11 57	"
20·00 E.-NE. " 29	13	16	"	" 22, '15	10 23	"
30·00 N.-) " 9	13	16	"	" 23, '15	35	"
18·00 E.-)						
8·00 N.- " 22	13	16	"	" 24, '15	58	"
35·00 E.- " 5	13	16	"	" 24, '15	11 01	"
15·00 E.- " 3	13	16	"	" 27, '15	10 28	"
At " 27	13	16	"	" 27, '15	11 10	"

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
20·00 N.-NE. cor. sec. 14	13	16	E. Pr.	Oct. 1, '15	10 49	W. A. Scott.
49·19 E. " 34	80	16	"	Sept. 10, '14	9 32	G. H. Herriot.
49·19 E. " " 34	80	16	"	" 10, '14	27	"
49·19 E. " " 34	80	16	"	" 10, '14	24	"
21·20 E. NW. " 31	84	16	"	" 9, '14	03	B. W. Waugh.
25·00 N. NE. " 5	13	17	"	Oct. 6, '15	12	W. A. Scott.
70·89 E. " " 35	84	17	"	Sept. 25, '14	8 50	B. W. Waugh.
75·88 E. " " 35	80	18	"	" 28, '14	9 48	G. H. Herriot.
31·51 E. NW. " 31	84	19	"	" 30, '14	9 06	B. W. Waugh.
66·06 E. NE. " 34	84	19	"	Oct. 6, '14	6 22	"
30·69 E. NW. " 31	80	20	"	" 6, '14	9 35	G. H. Herriot.
69·00 E. NE. " 31	80	20	"	" 7, '14	9 03	"
30·01 E. " " 32	84	20	"	" 7, '14	8 21	B. W. Waugh.
33·24 E. " " 32	84	21	"	Nov. 23, '14	36	G. H. Herriot.
67·86 E. " " 33	84	21	"	" 25, '14	25	"
25·20 E. " " 35	88	21	"	" 23, '14	16	B. W. Waugh.
25·20 E. " " 35	88	21	"	" 23, '14	16	"
25·20 E. " " 35	88	21	"	" 23, '14	14	"
52·00 E. " " 32	84	22	"	" 30, '14	10 46	G. H. Herriot.
12·72 N. " " 25	85	22	"	Dec. 7, '14	11 23	"
40·44 N. " " 14	87	22	"	" 16, '14	9 30	"
39·03 N. " " 2	88	22	"	" 19, '14	9 25	"
28·57 E. " " 33	88	22	"	Nov. 26, '14	7 48	B. W. Waugh.
16·53 N. " " 21	91	22	"	Dec. 5, '14	8 29	"
35·00 N. " " 13	74	1	Pr.	Sept. 6, '15	14 26	R. B. McKay.
At " " 13	74	1	"	" 7, '15	02	"
T.H. N. " " 36	81	1	"	" 8, '14	13 21	A. H. Hawkins.
75·90 N. " " 25	84	1	"	Aug. 27, '14	16 16	"
75·90 N. " " 25	84	1	"	" 28, '14	05	"
75·90 N. " " 25	84	1	"	Sept. 4, '14	16 21	"
52·60 N. " " 36	85	1	"	Aug. 13, '14	15 22	"
52·60 N. " " 36	85	1	"	" 13, '14	24	"
10·20 N. " " 24	86	1	"	" 14, '14	16 46	"
10·20 N. " " 24	86	1	"	" 14, '14	16 45	"
10·20 N. " " 24	86	1	"	" 17, '14	39	"
10·20 N. " " 24	86	1	"	" 18, '14	39	"
10·20 N. " " 24	86	1	"	" 20, '14	40	"
10·20 N. " " 24	86	1	"	" 21, '14	39	"
10·20 N. " " 24	86	1	"	" 24, '14	44	"
10·20 N. " " 24	86	1	"	" 25, '14	43	"
10·20 N. " " 24	86	1	"	" 26, '14	34	"
At " " 12	87	1	"	" 15, '14	12 19	"
43·00 S. " " 21	34	5	"	Dec. 9, '15	15 19	J. W. Tyrrell.
48·00 S. " " 20	34	5	"	" 10, '15	10	"
20·00 E. SE. " 5	35	5	"	" 4, '15	12	"
6·70 E. NE. " 31	36	5	"	July 18, '15	13 37	R. B. McKay.
2·00 N. " " 1	69	5	"	Dec. 9, '14	14 42	P. B. Street.
20·00 W. " " 20	70	5	"	Jan. 9, '15	15 01	"
20·00 N. " " 12	70	5	"	" 17, '15	26	"
20·00 S. " " 24	70	5	"	Feb. 14, '15	27	"
10·00 N. " " 10	70	5	"	" 26, '15	36	"
20·00 N. " " 26	70	5	"	Mar. 7, '15	31	"
10·00 W. " " 31	33	6	"	Aug. 20, '15	14 04	J. W. Tyrrell.
45·00 S. " " 21	33	6	"	" 25, '15	26	"
At " " 7	33	6	"	" 31, '15	08	"
40·00 W. " " 16	33	6	"	Sept. 2, '15	05	"
10·00 S. " " 7	34	6	"	" 16, '15	12	"
5·00 N. " " 19	34	6	"	" 17, '15	33	"
42·00 W. SE. " 2	35	6	"	Nov. 2, '15	15 01	"
40·00 S. NE. " 9	35	6	"	" 22, '15	14 54	"
30·00 N. " " 21	35	6	"	" 24, '15	42	"
30·00 S. " " 3	35	6	"	" 25, '15	15 04	"
At " " 36	35	6	"	Dec. 1, '15	14 39	"
2·00 N. " " 25	69	6	"	" 15, '14	15 41	P. B. Street.
At " " 22	70	6	"	Nov. 18, '14	15 16	"

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range	Meridian.	Date.	Declination.	Observer.
					° ′	
5·00 S. NE. cor. sec. 26	70	6	Pr.	Nov. 19, '14	14 49	P.B. Street.
12·00 N. " " 21	70	6	"	" 24, '14	14 34	"
38·00 N. " " 20	70	6	"	Jan. 1, '15	37	"
18·00 S. " " 26	70	6	"	" 23, '15	49	"
65·00 S. " " 8	70	6	"	" 25, '15	45	"
At " " 22	33	7	"	Aug. 10, '15	15 03	J. W. Tyrrell.
20·00 N. " " 13	33	7	"	" 12, '15	14 57	"
20·00 W. " " 25	33	7	"	" 30, '15	33	"
30·00 S. " " 25	34	7	"	Sept. 8, '15	27	"
10·00 S. " " 10	34	7	"	" 9, '15	55	"
20·00 N. " " 15	34	7	"	" 10, '15	38	"
24·00 W. " " 23	34	7	"	" 14, '15	28	"
10·00 N. " " 25	35	7	"	Oct. 27, '15	19	"
16·00 S.- " " 12	35	7	"	" 29, '15	29	"
25·00 S.- " " 3	35	7	"	Nov. 5, '15	27	"
20·00 E.- " " 23	35	7	"	" 8, '15	29	"
30·00 S.- " " 1	36	7	"	Oct. 26, '15	10	"
45·00 N.- " " 24	69	7	"	" 12, '14	43	P. B. Street.
38·00 N.- " " 1	70	7	"	" 25, '14	43	"
At ¼ cor. N. by. sec. 24	34	9	"	Feb. 25, '15	32	W. J. Deans.
At ½ " 24	34	9	"	" 27, 15	28	"
5·00 N.-NE. cor. sec. 24	34	9	"	" 27, '15	15 02	"
5·00 S.- " " 13	65	10	"	Jan. 2, '15	14 30	P. E. Palmer.
10·00 N.- " " 24	65	10	"	" 4, '15	13 25	"
35·00 N.- " " 36	65	10	"	" 5, '15	15 27	"
18·00 N.- " " 12	66	10	"	" 6, '15	14 26	"
22·00 N.- " " 24	66	10	"	" 8, '15	11 12	"
47·00 E.- " " 10	66	10	"	" 15, '15	12 41	"
56·00 S.- " " 7	66	10	"	" 18, '15	22 33	"
24·00 N.- " " 9	66	10	"	" 21, '15	10 26	"
0·36 E.- " " 32	32	12	"	Feb. 18, '15	14 49	W. J. Deans.
0·36 E.- " " 32	32	12	"	" 18, '15	45	"
At Sta. A5, traverse in sec. 27	48	13	"	Sept. 22, '14	14 46	"
" " " 27	48	13	"	" 22, '14	46	"
" " " 27	48	13	"	" 22, '14	41	"
At W.P. in Grand Rapids settlement	48	13	"	" 23, '14	58	"
54.71 S.-NE. cor. sec. 34	48	13	"	" 23, '14	31	"
54·71 S.- " " 34	48	13	"	" 23, '14	23	"
40·00 E.- " " 21	48	13	"	" 25, '14	52	"
40·00 E.- " " 21	48	13	"	" 25, '14	51	"
68·00 W.- " " 32	34	15	"	" 8, '15	15 50	O. Rolfson.
20·00 W.- " " 28	34	15	"	" 6, '15	14 49	"
44·00 S.- " " 3	35	15	"	" 2, '15	15 13	"
3·00 E.-SW. " 3	35	15	"	" 3, '15	37	"
30·00 W.-NE. " 26	35	15	"	Aug. 30, '15	29	"
1·00 N.- " " 11	35	15	"	" 31, '15	14 59	"
36·00 S.- " " 11	36	15	"	" 26, '15	15 40	"
40·00 W.- " " 24	36	15	"	" 26, '15	14 57	"
60·00 W.- " " 11	37	15	"	" 2, '15	30	"
20·00 S.- " " 16	37	15	"	" 5, '15	29	"
At " " 29	37	15	"	" 12, '15	15 00	"
At " " 18	38	15	"	" 12, '15	14 37	"
At " " 10	38	15	"	" 14, '15	50	"
65·00 W.- " " 24	38	15	"	" 20, '15	15 13	"
At " " 14	38	15	"	" 18, '15	14 57	"
At SE. " 1	35	16	"	Jan. 25, '15	37	W. J. Deans.
At NE. " 31	37	16	"	July 1, '15	13 27	O Rolfson.
28·00 N.- " " 28	37	16	"	" 8, '15	32	"
At " " 19	37	16	"	" 13, '15	16	"
30·00 N.- " " 8	37	16	"	" 16, '15	18	"
At " " 16	37	16	"	" 19, '15	14 10	"
At " " 8	37	16	"	" 26, '15	13 19	"
65·00 W.- " " 7	37	16	"	" 27, '15	26	"
12·00 N.- " " 8	37	16	"	" 30, '15	35	"
25·85 W.- " " 5	38	16	"	" 3, '15	13 48	"
43·00 N.- " " 4	38	16	"	" 5, '15	14 17	"

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
6·00 N.- NE. cor. sec. 26	34	17	Pr	Jan. 24, '15	15 03	W. J. Deans.
6·00 N.- " " 26	34	17	"	" 24, '15	14 59	"
5·00 N.- " " 23	34	17	"	" 25, '15	15 05	"
65·00 N.- " " 9	37	17	"	May 26, '15	14 12	O. Rolfson.
40·00 N.- " " 28	37	17	"	" 28, '15	13 47	"
At " " 34	37	17	"	June 1, '15	14 26	"
15·00 N.- " " 8	38	17	"	" 7, '15	15 30	"
At " " 16	38	17	"	" 12, '15	37	"
At " " 10	38	17	"	" 17, '15	30	"
28·00 N.- " " 15	38	17	"	" 18, '15	57	"
At " " 24	38	17	"	" 23, '15	09	"
20·00 W.- " " 1	38	17	"	" 25, '15	21	"
30·00 N.- " " 13	61	18	"	Feb. 15, '15	17 55	J. S. Galletly.
70·00 N.- " " 24	61	18	"	" 15, '15	18 00	"
15·00 N.- " " 25	61	18	"	" 16, '15	04	"
At " " 1	61	18	"	" 13, '15	08	"
30·00 N. " " 1	61	18	"	" 14, '15	09	"
70·00 N.- " " 12	61	18	"	" 14, '15	13	"
25·00 S.- " " 20	62	18	"	" 25, '15	17 58	"
65·00 S.- " " 17	62	18	"	" 25, '15	27	"
At " " 33	62	18	"	" 26, '15	18 05	"
20·00 N.- " " 9	62	18	"	" 27, '15	17 41	"
At " " 34	62	18	"	Mar. 1, '15	18 03	"
15·00 N.- " " 22	62	18	"	" 1, '15	12	"
40·00 S.- " " 35	62	18	"	" 2, '15	17 49	"
20·00 N.- " " 23	62	18	"	" 2, '15	18 10	"
20·00 W.- " " 24	62	18	"	" 3, '15	17 45	"
At " " 20	62	18	"	Feb. 24, '15	18 11	"
28·00 W.- " " 19	62	18	"	Jan. 18, '15	17 47	"
55·00 W.- " " 20	62	18	"	" 21, '15	18 13	"
40·00 W.- " " 7	62	18	"	" 22, '15	26	"
5·00 N. NE. cor. sec. 7	62	18	"	" 25, '15	22	"
At " " 19	62	18	"	" 25, '15	33	"
55·00 E. " " 20	62	18	"	" 29, '15	17 58	"
30·00 W. " " 9	62	18	"	" 26, '15	47	"
55·00 N. " " 1	62	18	"	Feb. 16, '15	52	"
At " " 12	62	18	"	" 18, '15	55	"
15·00 N. " " 24	62	18	"	" 19, '15	33	"
30·00 W. " " 36	62	18	"	" 19, '15	31	"
30·00 W. " " 36	62	18	"	" 22, '15	46	"
At " " 35	62	18	"	" 22, '15	18 11	"
35·00 W. " " 34	62	18	"	" 23, '15	07	"
55·00 S. " " 32	62	18	"	" 23, '15	07	"
70·00 S. " " 32	62	18	"	" 24, '15	09	"
70·00 S. " " 36	63	18	"	" 6, '15	13 44	"
70·00 S. " " 36	63	18	"	" 8, '15	42	"
25·00 S. " " 1	63	18	"	" 9, '15	18 01	"
40·00 N. " " 12	64	18	"	" 4, '15	13 48	"
15·00 S. " " 30	61	19	"	Dec. 31, '14	18 19	"
At " " 20	61	19	"	Jan. 1, '15	17 08	"
At " " 20	61	19	"	" 2, '15	08	"
30·00 S. " " 33	61	19	"	" 4, '15	11	"
At " " 36	61	19	"	" 15, '15	10	"
At " " 7	62	19	"	" 5, '15	19 58	"
35·00 W. " " 7	62	19	"	" 6, '15	20 05	"
35·00 W. " " 7	62	19	"	" 7, '15	09	"
60·00 W. " " 9	62	19	"	" 7, '15	16 24	"
35·00 S. " " 8	62	19	"	" 8, '15	41	"
15·00 N. " " 4	62	19	"	" 9, '15	18 20	"
15·00 N. " " 4	62	19	"	" 11, '15	14	"
8·00 E. " " 10	62	19	"	" 11, '15	14 01	"
20·00 N. " " 10	62	19	"	" 12, '15	57	"
35·00 E. " " 22	62	19	"	" 14, '15	38	"
At " " 1	62	19	"	" 16, '15	18 34	"
At " " 2	62	19	"	" 19, '15	16 45	"
50·00 N. " " 14	62	19	"	" 20, '15	50	"

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
15·00 S. N.E.cor. sec. 23	62	19	Pr.	Jan. 20, '15	16 24	J. S. Galletly.
50·00 S. " " 12	62	20	"	" 6, '15	19 34	"
At ¼ sec. cor. N. by sec. 32	60	21	"	Sept. 21, '15	16 08	R. B. McKay.
20·00 S. NE. cor. sec. 9	3	22	"	Oct. 28, '15	28	C. M. Walker.
At " " 28	3	22	"	" 29, '15	22	"
40·00 S. " " 31	43	25	"	Mar. 26, '15	33	W. J. Deans.
40·00 S. " " 31	43	25	"	" 26, '15	31	"
20·00 E. " " 31	24	27	"	July 30, '15	17 06	C. F. Aylsworth.
42·00 W. " " 32	24	27	"	Aug. 2, '15	16 52	"
5·00 S. " " 31	24	27	"	" 3, '15	57	"
41·50 S. " " 19	24	27	"	" 4, '15	32	"
21·00 S. " " 29	24	27	"	" 5, '15	40	"
69·50 S. " " 29	24	27	"	" 6, '15	43	"
At " " 29	24	27	"	" 9, '15	37	"
At " " 28	24	27	"	" 10, '15	17 17	"
6·00 S. " " 7	24	27	"	" 17, '15	16 07	"
2·00 W. " " 19	24	27	"	" 19, '15	39	"
30·00 W. " " 7	24	27	"	" 20, '15	09	"
18·50 N. " " 5	24	27	"	" 24, '15	23	"
11·50 W. " " 8	24	27	"	" 25, '15	23	"
19·00 W. " " 8	24	27	"	" 26, '15	32	"
64·50 N. " " 6	25	27	"	Sept. 9, '15	17 01	"
64·50 N. " " 6	25	27	"	" 14, '15	35	"
16·50 N. " " 4	25	27	"	" 21, '15	04	"
40·50 N. " " 28	25	27	"	" 26, '15	16 30	"
34·40 E. " " 29	25	27	"	" 29, '15	53	"
3·50 N. " " 19	25	27	"	" 30, '15	17 08	"
54·40 N. " " 30	25	27	"	Oct. 1, '15	16 55	"
25·50 E. " " 33	26	30	"	June 11, '15	36	"
28·80 W. " " 26	26	30	"	" 14, '15	15 43	"
At NW. " 18	23	31	"	" 18, '15	17 33	"
At NE. " 18	23	31	"	" 22, '15	31	"
21·00 N. " " 18	23	31	"	" 23, '15	18	"
11·50 N. " " 20	23	31	"	" 28, '15	19	"
20·00 W. " " 8	23	31	"	" 29, '15	25	"
At " " 16	23	31	"	July 4, '15	11	"
At " " 15	23	31	"	" 7, '15	23	"
7·00 E. " " 15	23	31	"	" 8, '15	16	"
20·00 S. " " 11	23	31	"	" 9, '15	20	"
3·00 N. " " 11	23	31	"	" 11, '15	10	"
38·00 W. " " 23	23	31	"	" 12, '15	02	"
20·00 E. " " 10	23	31	"	" 13, '15	28	"
1·50 N. " " 1	23	31	"	" 14, '15	14	"
At " " 15	23	31	"	" 18, '15	17	"
At " " 15	23	31	"	" 18, '15	16	"
30·00 W. " " 33	28	31	"	" 21, '15	18 40	"
At " " 28	28	31	"	" 23, '15	50	"
20·00 S. " " 33	28	31	"	" 24, '15	19 06	"
9·50 N. " " 4	29	31	"	" 27, '15	18 19	"
At " " 36	32	1	2	Oct. 8, '15	16 45	R. B. McKay.
19·60 N. " " 13	61	1	2	" 20, '14	19 44	A. H. Hawkins.
23·70 N. " " 13	61	1	2	" 21, '14	54	"
19·60 N. " " 13	61	1	2	" 22, '14	49	"
9·75 N. " " 12	62	1	2	" 28, '14	01	"
At " " 13	77	1	2	Dec. 25, '14	20 21	"
77·00 N. " " 24	79	1	2	Jan. 4, '15	11	"
77·00 N. " " 24	79	1	2	" 5, '15	19 38	"
77·00 N. " " 24	79	1	2	" 7, '15	28	"
77·00 N. " " 24	79	1	2	" 8, '15	20 12	"
77·00 N. " " 24	79	1	2	" 10, '15	10	"
77·00 N. " " 24	79	1	2	" 11, '15	11	"
77·00 N. " " 24	79	1	2	" 12, '15	10	"
77·00 N. " " 24	79	1	2	" 13, '15	10	"
Sta. 3, Trav. lake No. 1, sec. 7	13	4	2	June 27, '15	17 25	C. Rinfret.
Sta. 2 " " " 27	12	10	2	" 18, '15	18 31	"
" " " 27	12	10	2	" 19, '15	19	"

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
Sta. 2, Trav. lake No. 1, sec. 27	12	10	2	June 19, '15	18 31	C. Rinfret
" " " 27	12	10	2	" 21, '15	36	"
" " " 27	12	10	2	" 22, '15	40	"
Sta. 5, Trav. Moose Mountain lake, sec. 20	14	10	2	July 4, '15	18 44	"
" " " 20	14	10	2	" 4, '15	42	"
" " " 20	14	10	2	" 4, '15	47	"
40·00 N. NE. cor. sec. 16	32	10	2	Sept. 17, '15	19 55	W. A. Fletcher.
At " 8	33	10	2	Oct. 3, '15	27	"
Sta. 19, Trav. Chapleau lake, sec. 26	14	11	2	July 9, '15	18 19	C. Rinfret.
" " " 26	14	11	2	" 11, '15	27	"
" " " 26	14	11	2	" 11, '15	40	"
" " " 26	14	11	2	" 12, '15	26	"
At NE. cor. sec. 36	15	11	2	" 5, '15	19 02	"
Sta. 3, Trav. lake in sec. 30	15	11	2	" 7, '15	18 49	"
3·00 S. NE. cor. sec. 9	27	11	2	Oct. 16, '15	49	W. A. Fletcher.
6·50 N. " 5	27	11	2	" 20, '15	19 23	"
Sta. 2, Trav. lake in sec. 26	14	12	2	July 19, '15	18 34	C. Rinfret.
" " 26	14	12	2	" 25, '15	28	"
" " 26	14	12	2	" 26, '15	34	"
" " 26	14	12	2	" 26, '15	36	"
42·00 N. NE. cor. sec. 17	33	13	2	May 28, 15	20 15	J. H. McKnight.
29·00 E. NW. " 19	33	13	2	June 1, '15	07	"
30·00 N. NE. " 17	15	14	2	Aug. 2, '15	18 36	C. Rinfret.
At " " 14	27	14	2	June 12, '15	19 27	W. A. Fletcher.
40·00 W. " " 4	28	14	2	" 23, '15	18 56	"
40·00 W. " " 4	28	14	2	" 20, '15	19 07	"
41·00 N. " " 8	36	14	2	" 9, '15	19 50	J. H. McKnight.
At " " 18	37	14	2	" 28, '15	20 07	"
40·00 W. " " 10	38	14	2	" 29, '15	19 38	"
40·00 S. " " 2	16	15	2	Aug. 5, '15	18 43	C. Rinfret.
15·00 E. " " 22	27	15	2	July 25, '15	25	W. A. Fletcher.
40·00 S. " " 16	28	15	2	" 4, '15	10	"
At " " 16	28	15	2	" 6, '15	07	"
69·00 W. " " 36	38	15	2	" 20, '15	20 21	J. H. McKnight.
At " " 7	38	15	2	Aug. 9, '15	11	"
41·00 N. " " 20	39	15	2	" 10, '15	15	"
33·50 N. " " 5	15	16	2	" 7, '15	18 36	C. Rinfret.
33·50 N. " " 5	15	16	2	" 8, '15	35	"
33·50 N. " " 5	15	16	2	" 8, '15	36	"
33·50 N. " " 5	15	16	2	" 9, '15	37	"
40·00 W. " " 22	28	16	2	" 23, '15	07	W. A. Fletcher.
40·00 N. " " 4	38	16	2	Sept. 27, '15	19 54	J. H. McKnight.
0·06 N. " " 31	14	17	2	Aug. 20, '15	18 47	C. Rinfret.
Sta. 3, Trav. lake, sec. 26	15	17	2	" 10, '15	42	"
" " 26	15	17	2	" 12, '15	38	"
" " 26	15	17	2	" 15, '15	47	"
" " 26	15	17	2	" 15, '15	38	"
39·00 S. NE. cor. sec. 6	15	17	2	" 23, '15	47	"
4·00 N. " " 15	29	17	2	Sept. 5, '15	55	W. A. Fletcher.
56·00 E. " " 35	38	17	2	Oct. 13, '15	19 56	J. H. McKnight.
40·00 E. NE. " 9	39	17	2	" 18, '15	31	"
56·00 N. " " 16	40	17	2	" 20, '15	47	"
15·00 N. " " 10	39	18	2	" 30, '15	41	"
14·00 N. " " 10	41	18	2	Nov. 1, '15	53	"
Sta. 4, Trav. lake in sec. 29	3	19	2	June 6, '15	17 46	C. Rinfret.
" " 29	3	19	2	" 8, 15	43	"
" " 29	3	19	2	" 8, '15	33	"
23·30 on bea. 251° 43′ from NE. cor. sec. 11	12	20	2	Sept. 9, '15	18 30	"
23·30 on bea. 251° 43′ from NE. cor. sec. 11	12	20	2	" 9, '15	14	"
23·30 on bea. 251° 43′ from NE. cor. sec. 11	12	20	2	" 10, '15	20	"

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
40·00 W.-NE. cor. sec. 29	53	20	2	Oct. 1, '15	21 59	W. Christie.
16·00 S.- " 29	53	20	2	" 4, '15	22 13	"
35·00 N.- " 4	52	21	2	Sept. 3, '15	21 14	"
At " 9	52	21	2	" 4, '15	33	"
50·00 N.- " 4	52	21	2	" 5, '15	30	"
At " 11	52	21	2	" 6, '15	02	"
At " 13	52	21	2	" 7, '15	22 11	"
At " 22	52	21	2	" 8, '15	03	"
30·00 W.- " 29	52	21	2	" 13, '15	21 02	"
42·00 W.- " 30	52	21	2	" 14, '15	08	"
36·00 W.- " 31	52	21	2	" 20, '15	20 50	"
40·00 S.- " 22	53	21	2	" 10, '15	21 40	"
20·00 N.- " 5	53	21	2	" 16, '15	20 57	"
42·00 N.- " 20	53	21	2	" 17, '15	21 14	"
24·00 E.- " 32	53	21	2	" 23, '15	34	"
13·60 on bea. 265° 13′ from NE. cor. sec. 9	11	22	2	Oct. 20, '15	18 34	C. Rinfret..
13·60 on bea. 265° 13′ from NE. cor. sec. 9	11	22	2	" 21, '15	38	"
13·60 on bea. 265° 13′ from NE. cor. sec. 9	11	22	2	" 21, '15	34	"
Sta. 14, Trav. Moosejaw creek, sec. 34	13	22	2	Sept. 23, '15	36	"
22·00 on bea. 292° 25′ of ¼ sec. cor. E. by sec. 23	14	22	2	" 22, '15	38	"
22·00 on bea. 292° 25′ of ¼ sec. cor. E. by sec. 23	14	22	2	" 26, '15	37	"
22·00 on bea. 292° 25′ of ¼ sec. cor. E. by sec. 23	14	22	2	" 26, '15	40	"
22·00 on bea. 292° 25′ of ¼ sec, cor. E. by sec. 23	14	22	2	" 26, '15	38	"
At. NE. cor. sec. 20	38	22	2	Aug. 17, '15	20 32	R. Neelands.
40·00 S.-NE. cor. sec. 31	39	22	2	" 10, '15	22	"
15·00 N.- " 13	53	22	2	July 23, '15	19 19	W. Christie.
At " 36	53	22	2	" 24, '15	25	"
35·00 W.- " 34	53	22	2	" 26, '15	21 17	"
33·00 S.- " 29	53	22	2	Aug. 12, '15	22 16	"
At " 22	53	22	2	" 14, '15	21 51	"
20·00 S.- " 27	53	22	2	" 16, '15	49	"
20·00 N.- " 26	53	22	2	" 17, '15	19 57	"
At " 14	53	22	2	" 19, '15	23	"
22·90 S.- " 11	53	22	2	" 23, '15	18 27	"
35·00 W.- " 9	53	22	2	" 24, '15	24 01	"
40·00 W.- " 7	54	22	2	July 20, '15	22 33	"
20·00 S.- " 7	54	22	2	" 30, '15	21 59	"
12·00 N.- " 18	54	22	2	" 31, '15	55	"
At " 7	54	22	2	Aug. 2, '15	36	"
20·00 S.- " 22	54	22	2	" 5, '15	20 56	"
20·00 S.- " 12	54	22	2	" 7, '15	21	"
55·00 W.- " 10	54	22	2	" 10, '15	08	"
Sta. 3, Trav. Dahinda lake, sec. 15	9	23	2	May 31, '15	18 49	C. Rinfret.
" " " " 15	9	23	2	June 1, '15	51	"
" " " " 15	9	23	2	" 1, '15	53	"
Sta. 2, Trav. lake in sec. 18	11	23	2	Oct. 18, '15	58	"
" " " 18	11	23	2	" 19, '15	19 02	"
18·55 on bea. 152° 35′ of ¼ M. on N. by sec. 22	12	23	2	Sept. 30, '15	12	"
18·55 on bea. 152° 35′ of ¼ M. on N. by sec. 22	12	23	2	Oct. 1, '15	09	"
18·55 on bea. 152° 35′ of ¼ M. on N. by sec. 22	12	23	2	" 1, '15	09	"
26·60 on bea. 91° 27′ of NE. cor. sec. 12	13	23	2	Sept. 30, '15	16	"
" " " " 12	13	23	2	" 30, '15	13	"
Sta. 7, Trav. Moosejaw creek, sec. 30	15	23	2	" 16, '15	21	"
" " " " 30	15	23	2	" 17, '15	34	"
" " " " 30	15	23	2	" 17, '15	28	"
" " " " 30	15	23	2	" 17, '15	16	"

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RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
7·00 S.-NE. cor. sec. 5	41	23	2	Oct. 18, '15	20 03	J. M. Côté.
20·00 S.- " 12	41	23	2	" 19, '15	19 50	"
25·00 E.- " 9	41	23	2	" 22, '15	58	"
At " 36	53	23	2	July 28, '15	21 21	W. Christie.
At " 8	54	23	2	June 30, '15	23 00	"
At " 19	54	23	2	July 5, '15	27	"
40·00 W.- " 21	54	23	2	" 6, '15	06	"
At " 8	54	23	2	" 7, '15	22 53	"
At " 20	54	23	2	" 8, '15	51	"
30·00 W.- " 16	54	23	2	" 10, '15	23 41	"
20·00 N.- " 2	54	23	2	" 17, '15	07	"
Sta. 3, Trav. lake in sec. 2	12	24	2	Oct. 12, '15	18 49	C. Rinfret.
" " 2	12	24	2	" 14, '15	31	"
" " 2	12	24	2	" 14, '15	19 03	"
" " 2	12	24	2	" 15, '15	18 57	"
At NE. cor. sec. 34	23	24	2	June 7, '15	19 42	P. E. Palmer.
At " 20	42	24	2	" 30, '15	50	R. Neelands.
2·00 S.- " 23	44	24	2	May 26, '15	48	"
At " 27	53	24	2	June 2, '15	22 52	W. Christie.
At " 28	53	24	2	" 3, '15	29	"
At " 19	53	24	2	" 5, '15	43	"
At " 29	53	24	2	" 7, '15	29	"
36·00 W.- " 20	54	24	2	" 11, '15	23 23	"
10·00 W.- " 18	54	24	2	" 12, '15	22 53	"
60·00 W.- " 6	54	24	2	" 15, '15	34	"
At " 8	54	24	2	" 16, '15	39	"
At " 22	54	24	2	" 21, '15	43	"
At " 1	54	24	2	" 22, '15	23 12	"
At " 11	54	24	2	" 23, '15	22 41	"
4·00 S.- " 24	54	24	2	" 24, '15	51	"
Sta. 3, Trav. lake in sec. 25	11	25	2	Oct 3, '15	19 04	C Rinfret.
" " 25	11	25	2	" 5, '15	11	"
" " 25	11	25	2	" 11, '15	13	"
Sta 2, Trav. Gould lake in sec 17	11	25	2	" 4, '15	19 06	"
32·00 N-NE.. cor. sec. 21	21	25	2	June 1, '15	20 34	P E Palmer.
18·00 S.- " 4	22	25	2	" 2, '15	33	"
12·00 E.-¼ on E. by sec. 4	24	25	2	" 5, '15	19 56	"
16·00 W.-¼ " 4	24	25	2	" 7, '15	20 02	"
5·00 N.-NE. cor. sec. 21	37	25	2	Aug 24, '15	19 59	R. Neelands.
20·00 W.- " 35	23	26	2	June 9, '15	20 25	P. E. Palmer.
At " 34	25	26	2	" 11, '15	10	"
40·00 S.- " 28	25	26	2	" 11, '15	13	"
40·00 S.- " 28	25	26	2	" 13, '15	06	"
At " 9	27	26	2	" 14, '15	39	"
At " 9	27	26	2	" 15, '15	48	"
At " 9	28	26	2	" 21, '15	50	"
At " 16	29	26	2	Sept. 8, '15	53	"
20·00 N.-SE.- " 3	31	26	2	June 26, '15	21 00	"
16·00 S.-NE. " 18	32	26	2	Oct. 8, '15	21 16	"
40·00 W.- " 24	42	26	2	June 15, '15	19 56	R. Neelands.
At " 10	43	26	2	" 4, '15	56	"
12·00 N.- " 9	13	27	2	May 16, '15	26	S. L. Evans.
4·00 N.-SE. " 1	13	27	2	" 18, '15	26	"
12·00 N.- " 2	13	27	2	" 18, '15	23	"
36·00 N.- " 3	13	27	2	" 19, '15	21	"
24·00 N.- " 5	13	27	2	" 19, '15	28	"
9·00 N.- " 6	13	27	2	" 21, '15	13	"
2·00 N.-SW. " 6	13	27	2	" 21, '15	11	"
1·00 S.-NE. " 20	13	27	2	" 22, '15	15	"
7·00 S.- " 21	13	27	2	" 25, '15	19	"
3·00 S.- " 22	13	27	2	" 25, '15	17	"
24·00 W.- " 32	27	27	2	July 5, '15	20 50	P. E. Palmer.
At " 31	27	27	2	" 12, '15	21 14	"
8·00 W.- " 34	28	27	2	June 28, '15	20 52	"
At " 14	29	27	2	Sept. 4, '15	59	"
40·00 S.- " 22	30	27	2	" 16, '15	20 59	"

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					′	
10·00 E.-¼ pits E. by sec. 28	31	27	2	Sept. 19, '15	21 09	P. E. Palmer.
7·40 E.-NE. cor. sec. 7	33	27	2	Oct. 13, '15	20 54	"
At " 2	33	27	2	" 18, '15	21 22	"
15·00 N.- " 21	37	27	2	Aug. 29, '15	11	R. Neelands.
30·00 W.- " 21	38	27	2	Sept. 5, '15	43	"
45·00 S.- " 3	43	27	2	Oct. 12, '15	20 28	J. M. Côté.
At SE. " 2	43	27	2	" 13, '15	38	"
30·00 W.-NE. " 36	21	28	2	Aug. 2, '15	42	P. E. Palmer.
8·00 N.-SE. " 6	23	28	2	" 6, '15	18	"
40·00 N.-NE. " 36	24	28	2	July 20, '15	20	"
8·00 E.- " 20	25	28	2	" 19, '15	21 00	"
At " 31	27	28	2	" 10, '15	12	"
40·00 S.- " 24	29	28	2	Aug. 30, '15	20 59	"
40·00 W.- " 21	30	28	2	" 23, '15	21 07	"
At " 19	21	29	2	" 1, '15	20 08	"
8·00 W. " 34	29	29	2	" 13, '15	21 07	"
8·00 W.- " 34	29	29	2	" 15, '15	13	"
10·00 N.- " 25	24	1	3	July 22, '15	20 50	"
10·00 N.- " 25	24	1	3	" 25, '15	51	"
25·00 W.-½ E. by sec. 1	26	1	3	" 18, '15	53	"
At NE. cor. sec. 36	28	1	3	Aug. 10, '15	21 09	"
30·00 S.- " 16	29	1	3	" 18, '15	01	"
40·00 S.- " 15	30	1	3	" 19, '15	15	"
At " 12	68	1	3	Mar. 15, '15	23 12	R. B. McKay.
At " 12	68	1	3	" 20, '15	13	"
35·00 N.- " 25	22	2	3	July 29, '15	20 30	P. E. Palmer.
2·00 W.-SE. " 2	43	2	3	Aug. 5, '15	24 44	J. M. Côté.
39·00 W.-NE. " 3	43	2	3	" 7, '15	49	"
2·00 W.-SE. " 1	43	2	3	" 9, '15	25 13	"
12·00 E.-NE. " 19	43	2	3	" 13, '15	24 44	"
2·00 S.-NE. cor. sec. 2	43	2	3	" 14, '15	24 48	"
7·00 N.- " 11	43	2	3	" 16, '15	53	"
33·00 S.- " 17	43	2	3	" 18, '15	31	"
6·00 S.- " 27	43	2	3	" 19, '15	54	"
At " 32	43	2	3	" 24, '15	37	"
At " 27	43	2	3	" 25, '15	35	"
9·00 W.- " 24	43	2	3	" 28, '15	25 07	"
16·00 E.- " 34	43	2	3	Sept. 7, '15	20	"
13·00 N.- " 10	44	2	3	" 3, '15	24 38	"
30·00 E.- " 11	44	2	3	" 13, '15	57	"
20·00 S.- " 20	44	2	3	" 17, '15	24	"
55·00 W.- " 31	44	2	3	" 18, '15	49	"
55·00 W.- " 31	44	2	3	" 20, '15	34	"
54·00 N.- " 24	44	2	3	" 27, '15	26	"
2·00 S.- " 24	44	2	3	" 30, '15	27	"
At ¼ sec. cor. E. by sec. 10	44	2	3	Oct. 3, '15	39	R. Neelands.
At NE. cor. sec. 28	44	2	3	Sept. 29, '15	30	"
7·00 W.- " 29	45	2	3	Oct. 4, '15	50	"
40·00 S.- " 18	47	3	3	" 27, '15	39	"
At " 19	47	3	3	" 29, '15	27	"
32·00 N.-SE. " 3	15	4	3	June 6, '15	20 37	S. L. Evans.
8·00 N.- " 2	15	4	3	" 6, '15	35	"
5·00 N.- " 1	15	4	3	" 6, '15	42	"
1·10 N.-NE. " 6	15	4	3	" 18, '15	34	"
3·50 N.- " 5	15	4	3	" 18, '15	28	"
At " 32	24	4	3	July 26, '15	56	P. E. Palmer.
22·00 E.- " 33	15	5	3	June 12, '15	52	S. L. Evans.
11·00 N.-SE. " 4	15	5	3	" 14, '15	59	"
0·50 W.- " 1	15	5	3	" 16, '15	40	"
3·00 N.- " 2	15	5	3	" 16, '15	39	"
2·00 W.- " 3	15	5	3	" 16, '15	43	"
42·00 N.-NE. " 1	15	5	3	" 18, '15	49	"
20·00 S.- " 8	17	5	3	July 11, '15	21 05	"
46·00 N.-SE. " 4	17	5	3	" 15, '15	03	"
38·00 S.-NE. " 23	17	5	3	" 21, '15	01	"
25·00 S.- " 22	17	5	3	" 21, '15	20 50	"

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
20·00 S.-N.E. cor. sec. 5	32	5	3	Oct. 25, '15	22 38	S. L. Evans
32·00 S.- " 4	32	5	3	" 27, '15	25	"
20·00 N.- " 13	32	5	3	" 29, '15	26	"
31·80 N.- " 3	17	6	3	July 19, '15	21 00	"
1·00 N.- " 29	17	6	3	Aug. 2, '15	03	"
12·00 N.- " 19	17	6	3	" 2, '15	05	"
40·00 W.- " 11	18	6	3	Oct. 14, '15	27	C. M. Walker.
20·00 S.- " 9	17	7	3	" 3, '15	05	"
2·60 S.- " 24	18	7	3	" 13, '15	30	"
25·00 S.- " 30	44	7	3	" 22, '15	01	R. Neelands.
40·00 W.- " 24	44	7	3	" 22, '15	23	"
40·00 W.- " 31	15	8	3	Aug. 3, '15	04	G. C. Cowper.
40·00 S.- " 33	18	8	3	" 12, '15	35	"
10·00 S., 18·50 E.-NE. cor. sec. 5	19	8	3	" 8, '15	32	"
4·00 S.-NE. cor. sec. 23	26	8	3	" 21, '15	05	S. L. Evans.
4·00 S.- " 24	26	8	3	" 24, '15	11	"
45·00 S.- " 22	26	8	3	" 25, '15	02	"
15·00 W.-SE. " 3	26	8	3	" 28, '15	39	"
15·00 S.-NE. " 21	26	8	3	Sept. 5, '15	29	"
6·00 N.- " 20	26	8	3	" 5, '15	26	"
27·00 S.- " 19	26	8	3	" 5, '15	29	"
At " 33	45	8	3	Oct. 13, '15	20 55	R. Neelands.
40·00 S.- " 23	44	8	3	" 9, '15	53	"
7·50 N.- " 28	44	8	3	" 16, '15	21 00	"
10·00 S.- " 24	26	9	3	Sept. 5, '15	24	S. L. Evans.
1·00 N.- " 23	26	9	3	" 8, '15	34	"
50·00 N.- " 7	26	9	3	" 14, '15	43	"
25·00 S.- " 20	26	9	3	" 14, '15	46	"
20·00 S.- " 21	26	9	3	" 14, '15	21 50	"
32·00 S.- " 34	26	9	3	" 17, '15	45	"
5·00 N.- " 4	16	10	3	Aug. 1, '15	27	G. C. Cowper.
5·00 N.- " 4	16	10	3	" 1, '15	29	"
At " 24	19	10	3	" 14, '15	19	"
1·00 N.- " 19	26	10	3	Sept. 29, '15	42	S. L. Evans.
10·00 S.- " 20	26	10	3	" 30, '15	42	"
25·00 S.- " 28	26	10	3	Oct. 3, '15	41	"
25·00 W.- " 32	26	10	3	" 7, '15	40	"
40·00 N.- " 6	46	10	3	June 7, '15	23 21	E. P. Bowman.
38·20 E., 7·00 N.-NE. cor. sec. 23	16	12	3	July 27, '15	21 39	G. C. Cowper.
38·20 E.-7·00 N., NE. cor. sec. 23	16	12	3	" 27, '15	45	"
40·00 N.- " 18	18	12	3	Aug. 24, '15	19	"
40·00 N.- " 18	18	12	3	" 24, '15	21	"
20·00 S.- " 19	57	12	3	Dec. 13, '14	24 45	W. J. Deans.
10·00 S.- " 28	16	14	3	Sept. 3, '15	20 45	G. C. Cowper.
10·00 S.- " 28	16	14	3	" 3, '15	45	"
1·00 S.- " 28	32	14	3	Oct. 5, '15	23 13	G. A. Bennett.
30·00 S.- " 14	36	14	3	May 3, '15	22	R. C. Purser
17·00 W.- " 33	36	14	3	" 5, '15	48	"
17·00 W.- " 33	36	14	3	" 6, '15	49	"
At ¼ cor. E. by sec. 8	36	14	3	" 17, '15	16	"
40·00 E.-NE. cor. sec. 32	39	14	3	June 15, '15	53	J. M. Côté.
30·00 W.- " 7	40	14	3	" 7, '15	44	"
30·00 W.- " 7	40	14	3	" 8, '15	49	"
At " 33	40	14	3	" 20, '15	24 04	"
25·00 N.- " 26	40	14	3	" 23, '15	30	"
45·50 W., 9·50 N.-NE. cor. sec. 33	19	15	3	Sept 16, '15	21 29	G. C. Cowper.
5·70 W., 36·00 S.-NE. cor. sec. 35	19	15	3	" 17, '15	55	"
44·00 S.-NE. cor. sec. 32	19	1	3	" 20, '15	42	C. M. Walker
At " 10	35	15	3	May 7, '15	23 23	R. C. Purser.
At " 10	35	15	3	" 12, '15	27	"
At " 8	36	15	3	" 11, '15	24 08	"
6·00 S., 39·00 E.-NE. cor. sec. 30	51	15	3	Aug. 10, '15	25 45	E. P. Bowman.
18·00 N., 6·00 E.-NE. cor. sec. 17	51	15	3	" 10, '15	26 14	"
40·00 S.- " 6	51	15	3	" 26, '15	25 15	"
5·00 N., 13·00 W.-NE. cor. sec. 18	52	15	3	Dec. 2, '15	27 32	"
8·27 N.-¼ sec. cor. E. by sec. 24	52	15	3	" 3, '15	24 36	"

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
At NE. cor. sec. 19	12	16	3	June 20, '15	20 44	G. C. Cowper.
1·60 E.- " 31	15	16	3	July 12, '15	21 57	"
At " 19	17	16	3	" 15, '15	22 17	"
33·00 W.- " 35	17	16	3	Sept. 6, '15	12	"
15·00 S.- " 22	38	16	3	May 18, '15	23 53	R. C. Purser.
5·00 N.- " 2	38	16	3	" 19, '15	24 13	"
20·00 W.- " 11	38	16	3	" 30, '15	16	"
30·00 N., 28·00 E. NE. cor. sec. 20	51	16	3	Aug. 2, '15	25 49	E. P. Bowman.
20·00 N.- " 22	61	16	3	Dec. 21, '14	38	W. J. Deans.
20·00 N.- " 22	61	16	3	" 23, '14	44	"
At " 35	61	16	3	" 28, '14	42	"
10·00 N.- " 34	61	16	3	" 29, '14	53	"
At ¼ sec. cor. N. by sec. 23	61	16	3	" 30, '14	44	"
40·00 N.-NE. cor. sec. 24	14	17	3	June 21, '15	21 32	G. C. Cowper.
40·00 N.- " 24	14	17	3	" 21, '15	30	"
40·00 W.- " 21	15	17	3	July 8, '15	50	"
12·00 N.- " 23	18	17	3	Sept. 10, '15	53	C. M. Walker.
31·00 N.- " 20	36	17	3	June 15, '15	24 53	G. A. Bennett.
39·00 N.-SE. " 3	37	17	3	" 7, '15	23 55	"
39·00 N.- " 3	37	17	3	" 10, '15	56	"
60·75 W.-NE. " 32	51	17	3	July 26, '15	25 50	E. P. Bowman.
6·32 W.- " 21	51	17	3	" 27, '15	26	"
15·00 W.- " 9	52	17	3	Sept. 4, '15	36	"
35·20 W.- " 33	11	18	3	" 29, '15	21 11	A. M. Narraway.
35·70 N.- " 12	12	18	3	" 30, '15	21 09	"
19·20 S.- " 23	12	18	3	Oct. 1, '15	16	"
At " 9	12	18	3	" 7, '15	22 18	"
1·00 E.- " 34	15	18	3	June 26, '15	17	G. C. Cowper.
1·00 E.- " 34	15	18	3	" 27, '15	17	"
1·00 E.- " 34	15	18	3	" 27, '15	18	"
1·00 E.- " 34	15	18	3	" 27, '15	21	"
1·00 E.- " 34	15	18	3	" 27, '15	25	"
1·00 E.- " 34	15	18	3	" 27, '15	25	"
1·00 E.- " 34	15	18	3	" 27, '15	21	"
1·00 E.- " 34	15	18	3	" 27, '15	19	"
1·00 E.- " 34	15	18	3	" 27, '15	19	"
1·00 E.- " 34	15	18	3	" 27, '15	21	"
1·00 E.- " 34	15	18	3	" 27, '15	18	"
46·00 S.- " 18	18	18	3	Oct. 21, '15	21 43	"
7·00 E., 33·00 N.-NE. cor. sec. 7	22	18	3	" 8, '15	22 48	"
30·00 W., 24·00 S.-NE. cor. sec. 17	22	18	3	" 15, '15	37	"
30·00 E.-NE. cor. sec. 34	31	18	3	" 3, '15	23	G. A. Bennett.
1·50 N., 45·50 E.-¼ sec. on E. by sec. 16	52	18	3	Sept. 14, '15	26 36	E. P. Bowman.
At NE. cor. sec. 36	72	18	3	April 6, '14	27 17	A. Saint Cyr.
At " 24	12	19	3	Sept. 28, '15	21 20	A. M. Narraway.
5·00 S.- " 36	18	19	3	" 16, '15	57	C. M. Walker.
26·00 S.- " 35	21	19	3	" 7, '15	22 37	A. M. Narraway.
8·00 N.- " 11	22	19	3	Aug. 30, '15	34	"
39·00 E.- " 8	22	19	3	Sept. 3, '15	19	"
24·00 S.- " 16	22	19	3	" 5, '15	21	"
24·70 S.- " 11	22	19	3	" 6, '15	32	"
34·10 E.- " 31	22	19	3	" 8, '15	08	"
21·50 W.- " 31	22	19	3	" 9, '15	03	"
38·50 S.- " 33	22	19	3	" 10, '15	15	"
11.00 W.-NE. cor. sec 34	22	19	3	" 10, '15	16	"
35·50 N.- " 26	22	19	3	Aug. 13, '15	30	"
At " 3	23	19	3	Sept. 14, '15	06	"
39.00 S.- " 9	23	19	3	" 16, '15	14	"
At " 21	50	19	3	July 7, '15	26 15	E. P. Bowman.
6.00 N.- " 10	51	19	3	" 20, '15	13	"
18.50 S., 3·75 E.-¼ cor. on E. by sec. 27	52	19	3	Sept. 20, '15	22	"
At NE. cor. sec. 35	8	20	3	July 10, '15	21 34	A. M. Narraway.
24·00 S.- " 31	9	20	3	" 6, '15	29	"
10·00 S.- " 12	49	20	3	June 28, '15	25 47	E. P. Bowman.

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RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
27·00 S.-N.E. cor. sec. 4	53	20	3	Sept. 23, '15	25 16	E. P. Bowman.
13·65 N., 36·70 E.-NE. cor. sec. 29	54	20	3	Oct. 15, '15	24 42	"
13·65 N., 36·70 E.-NE. cor. sec. 29	54	20	3	" 16, '15	41	"
3·40 E., 21·50 S.NE. cor. sec. 30	6	21	3	June 6, '15	21 33	G. C. Cowper.
3·40 E., 21·50 S.- " 30	6	21	3	" 6, '15	31	"
At NE. cor. sec. 31	30	21	3	July 5, '15	53	J. M. Cété.
30·00 S.- " 21	30	21	3	" 6, '15	20 48	"
12·00 S., 37·25 E.-NE. cor. sec. 15	52	21	3	Oct. 23, '15	24 40	E. P. Bowman.
40·00 N.-SE. cor. sec. 3	13	22	3	Aug. 17, '15	22 23	C. M. Walker.
35·00 N.-NE. " 12	16	22	3	" 12, '15	23 06	A. M. Narraway.
78·50 E.- " 32	16	22	3	" 14, '15	21 55	"
22·50 S.- " 29	16	22	3	" 17, '15	40	"
26·00 S.- " 16	16	22	3	" 18, '15	4	"
20·00 N.- " 20	47	22	3	May 16, '15	24 00	J. M. Côté.
At " 32	47	22	3	" 17, '15	23 28	"
32·00 N.- " 4	47	22	3	" 21, '15	24 57	"
20·00 N.-SE. " 2	47	22	3	" 25, '15	25 27	"
At " 4	47	22	3	" 28, '15	16	"
At " 6	47	22	3	" 29, '15	24 40	"
40·00 N.- " 3	47	22	3	" 30, '15	25 37	"
At NE. cor. sec. 34	47	22	3	Aug. 22, '15	24 09	R. C. Purser.
35·00 N.- " 34	47	22	3	" 23, '15	17	"
At " 36	12	23	3	July 19, '15	22 22	A. M. Narraway.
20·50 W.- " 36	12	23	3	" 21, '15	17	"
24·30 S.- " 33	12	23	3	" 21, '15	19	"
40·00 W.- " 32	12	23	3	" 21, '15	22	"
6·00 N.- " 13	13	23	3	" 19, '15	25	"
At " 36	16	23	3	Aug. 11, '15	23 30	"
21·00 N.- " 7	34	23	3	June 29, '15	17	G. A. Bennett.
28·00 E.- " 19	34	23	3	July 3, '15	24	"
13·00 S.- " 8	36	23	3	" 9, '15	29	"
12·00 S.- " 5	45	23	3	Aug. 17, '15	24 25	R. C. Purser.
10·00 E.-¼ cor. N. by sec. 10	45	23	3	" 18, '15	29	"
At NE. cor. sec. 24	47	23	3	May 13, '15	23 29	J. M. Côté.
40·00 W.- " 31	51	23	3	April 27, '15	24 32	"
8·00 S.- " 28	51	23	3	May 2, '15	42	"
32·00 N.- " 14	51	23	3	" 4, '15	41	"
6·00 N.- " 26	51	23	3	" 6, '15	41	"
8·00 S.- " 28	51	23	3	" 8, '15	47	"
32·75 S.-¼ cor. E. by sec. 1	51	24	3	Nov. 12, '15	37	E. P. Bowman.
10·00 N.-NE. cor. sec. 15	34	24	3	June 28, '15	23 21	G. A. Bennett.
43·00 W.-SE. " 2	35	24	3	July 2, '15	44	"
60·00 S.-NE. " 35	36	24	3	" 10, '15	47	"
19·00 S.-¼ cor. E. by sec. 24	51	24	3	Nov. 6, '15	24 44	E. P. Bowman.
8·50 W.-NE. cor. sec. 11	11	25	3	May 6, '15	22 38	A. M. Narraway.
At " 11	11	25	3	" 7, '15	01	"
40·00 W.-SE. " 4	31	25	3	Sept. 6, '15	23 32	G. A. Bennett.
40·00 S.-NE. " 29	32	25	3	" 8, '15	24 06	"
At " 7	34	25	3	" 11, '15	12	"
3·00 N., 12·00 W.-NE. cor. sec. 27	50	25	3	Oct. 28, '15	14	E. P. Bowman.
46·10 S.-NE. cor. sec. 22	13	26	3	June 15, '15	22 16	A. M. Narraway.
67·50 S.- " 15	13	26	3	" 16, '15	22 24	"
5·00 N.- " 16	13	26	3	" 16, '15	29	"
At " 19	13	26	3	" 18, '15	36	"
At " 7	13	26	3	" 18, '15	34	"
31·00 N.- " 5	35	26	3	July 15, '15	24 07	G. A. Bennett.
48·00 S.- " 24	35	26	3	" 22, '15	35	"
65·00 E.- " 20	36	26	3	" 26, '15	23 58	"
5·00 N.- " 23	27	27	3	" 10, '15	02	J. M. Côté.
15·00 S.- " 15	27	27	3	" 12, '15	10	"
35·00 N.- " 20	27	27	3	" 15, '15	39	"
10·00 S.- " 23	27	27	3	" 17, '15	04	"
2·00 N.-NW. " 30	27	27	3	" 19, '15	56	"
38·00 S.-NE. " 18	27	27	3	" 20, '15	38	"
17·00 E.- " 21	27	27	3	" 21, '15	26	"
46·00 N.- " 20	35	27	3	" 28, '15	24 12	G. A. Bennett

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
3·00 S.- cor. sec. 24	36	27	3	July 26, '15	24 03	G. A. Bennett.
40·00 S.- " 36	31	28	3	Sept. 1, '15	00	"
At " 27	31	28	3	" 3, '15	23 47	"
23·00 S.- " 1	32	28	3	Aug. 27, '15	47	"
40·00 S.- " 11	32	28	3	" 25, '15	41	"
47·50 S - " 21	34	28	3	" 11, '15	57	"
At " 35	12	29	3	May 24, '15	22 43	A. M. Narraway.
At " 34	12	29	3	" 25, '15	33	"
10·00 N.- " 4	13	29	3	" 22, '15	29	"
25·75 N.- " 14	13	29	3	" 24, '15	41	"
At " 15	13	29	3	" 25, '15	37	"
At " 17	14	29	3	June 8, '15	23 46	"
40·00 W.- " 7	23	1	4	" 27, '15	24 13	O. B. Roberts.
5·00 N.- " 20	24	1	4	" 14, '15	45	"
40·00 S.- " 27	25	1	4	" 13, '15	43	"
7·00 S.- " 26	27	1	4	" 1, '15	56	"
At " 2	27	1	4	" 9, '15	59	"
40·00 S.- " 12	28	1	4	May 30, '15	47	"
11·00 S.- " 6	28	1	4	" 31, '15	04	"
40·00 E.- " 31	30	1	4	Aug. 2, '15	23 34	"
40·00 S.- " 8	30	1	4	" 2, '15	56	"
At " 29	31	1	4	July 29, '15	12	"
At " 6	31	1	4	" 30, '15	42	"
At " 24	31	1	4	Aug. 3, '15	18	"
11·00 S.- " 17	31	1	4	July 29, '15	22 47	"
At " 36	32	1	4	Oct. 28, '15	21 27	R. B. McKay.
8·00 N.- " 10	32	1	4	Aug. 11, '15	23 04	O. B. Roberts.
At " 3	32	1	4	" 11, '15	04	"
40·00 S.- " 34	32	1	4	" 12, '15	15	"
At " 35	32	1	4	" 12, '15	20	"
At " 23	32	1	4	" 12, '15	36	"
At " 5	32	1	4	" 13, '15	10	"
40·00 S.- " 17	33	1	4	" 7, '15	26 26	"
57·00 S.- " 4	43	1	4	July 28, '15	24 35	G. W. Coltham.
1·00 N.- " 21	44	1	4	Aug. 4, '15	33	E. S. Martindale.
5·00 W.-¼ cor. N. by sec. 35	52	1	4	June 7, '15	26 07	R. C. Purser.
15·00 S.-NE. cor. sec. 34	52	1	4	" 8, '15	06	"
1·50 N.- " 15	52	1	4	" 8, '15	25 53	"
10·00 S.-¼ cor. E. by sec. 10	53	1	4	" 5, '15	26 01	"
10·00 S.-NE. cor. sec. 11	53	1	4	" 10, '15	01	"
15·00 E.- " 9	53	1	4	" 11, '15	25 48	"
15·00 S.- " 35	53	1	4	" 14, '15	27	"
61·27 W.- " 32	104	1	4	May 24, '15	30 37	F. V. Seibert.
54·90 W.- " 31	104	1	4	" 25, '15	35	"
At " 23	20	2	4	Sept. 25, '15	23 09	R. C. Purser
20·00 W.- " 36	28	2	4	July 25, '15	25 02	O. B. Roberts.
40·00 S.- " 30	28	2	4	" 23, '15	24 15	"
At " 35	29	2	4	31, '15	51	"
40·00 S.- " 33	30	2	4	" 31, '15	40	"
At " 6	31	2	4	Aug. 4, '15	25 03	"
40·00 S.- " 16	32	2	4	" 17, '15	24 43	"
At " 25	32	2	4	" 18, '15	23 58	"
9·78 S.- " 3	32	2	4	" 19, '15	24 12	"
At " 31	33	2	4	" 16, '15	33	"
At " 8	33	2	4	" 17, '15	39	"
At SW. " 6	23	3	4	July 9, '15	14	"
At NE. " 5	23	3	4	Sept. 23, '15	22 44	"
3·25 W.- " 7	24	3	4	July 5, '15	23 23	"
40·00 S.- " 3	24	3	4	" 10, '15	37	"
40·00 S.- " 26	25	3	4	" 7, '15	35	"
20·00 E.- " 34	26	3	4	" 11, '15	24 41	"
13·00 S.- " 21	30	3	4	Aug. 31, 15	34	"
3·00 S.- " 24	32	3	4	" 26, '15	25 36	"
At " 27	32	3	4	" 26, '15	52	"
55·00 S.- " 17	32	3	4	" 27, '15	20	"
40·00 W.- " 12	33	3	4	" 9, '15	42	"

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
At N.E. cor. sec. 1	33	3	4	Aug. 9, '15	25 46	O. B. Roberts.
40·00 S.- " 22	33	3	4	" 9, '15	26 28	"
At " 4	33	3	4	" 10, '15	36	"
At " 16	33	3	4	" 21, '15	06	"
At " 4	33	3	4	" 21, '15	15	"
10·00 S.- " 2	43	3	4	July 1, '15	24 17	R. C. Purser.
0·50 N.- " 36	44	3	4	Aug. 9, '15	28	E. S. Martindale.
45·00 E., 20·00 S.-NE. cor. sec. 19	45	3	4	" 10, '15	26 15	"
At " 30	45	3	4	" 10, '15	25 47	"
At " 11	46	3	4	" 20, '15	27 07	"
At " 11	46	3	4	" 20, '15	12	"
4·00 S., 40·00 W.-NE. cor. sec. 4	47	3	4	Aug. 31, '15	26 09	"
36·00 S.-NE. cor. sec. 6	47	3	4	Sept. 1, '15	25 53	"
4·00 S., 40·00 W.-NE. cor. sec. 4	47	3	4	" 1, '15	26 14	"
25·53 W.-NE. cor. sec. 36	100	3	4	June 14, '14	30 09	F. V. Seibert.
At " 31	104	3	4	" 1, '15	12	"
40·00 N.- " 18	23	4	4	July 10, '15	23 42	O. B. Roberts.
At " 16	24	4	4	" 6, '15	28	"
At " 9	25	4	4	" 8, '15	34	"
40·00 S.- " 25	27	4	4	Sept. 3, '15	24 36	"
At " 9	27	4	4	" 3, '15	36	"
At " 21	27	4	4	" 4, '15	52	"
5·00 S.- " 18	27	4	4	" 4, '15	29	"
40·00 S.- " 2	28	4	4	" 7, '15	12	"
11·21 S.- " 31	28	4	4	" 7, '15	25 12	"
At " 7	44	4	4	July 12, '15	27 26	G. W. Coltham.
42·82 N.- " 24	45	4	4	Aug. 11, '15	25 38	E. S. Martindale.
27·60 E., 15·40 N.-NE. cor. sec. 21	47	4	4	Sept. 3, '15	52	"
39·00 S.-NE. cor. sec. 14	24	5	4	" 28, '15	24 49	O. B. Roberts.
40·00 S.- " 19	25	5	4	" 16, '15	25	"
15·00 N.- " 20	26	5	4	" 15, '15	06	"
At " 32	26	5	4	" 15, '15	05	"
40·00 S.- " 26	27	5	4	" 8, '15	15	"
12·00 W.-¼ cor. N. by sec. 33	28	5	4	July 20, '15	07	R. C. Purser.
Sta. 5, Barnes lake, sec. 1	44	5	4	" 3, '15	25 26	G. W. Coltham.
12·00 S.-NE. cor. sec. 19	45	5	4	June 10, '15	24 52	"
36·00 W.- " 10	45	5	4	" 18, '15	25 28	"
1·00 N.- " 20	46	5	4	Sept. 7, '15	29	E. S. Martindale.
20·00 S.-¼ cor. E. by sec. 3	57	5	4	Aug. 28, '15	28	R. C. Purser.
13·50 N.-NE. cor. sec. 16	57	5	4	Sept. 1, '15	26 02	"
20·00 S.-¼ cor. E. by sec. 4	58	5	4	" 8, '15	17	"
At NE. cor. sec. 31	104	5	4	June 5, '15	29 59	F. V. Seibert.
8·00 S.- " 30	23	6	4	Sept. 30, '15	24 33	O. B. Roberts.
36·47 S.- " 28	24	6	4	" 29, '15	08	"
30·00 N.- " 5	25	6	4	" 17, '15	05	"
3·27 N.- " 27	26	6	4	" 14, '15	02	"
At " 32	26	6	4	" 14, '15	23 55	"
28·75 S.- " 9	26	6	4	" 14, '15	58	"
11·48 S.- " 8	27	6	4	Oct. 25, '15	41	"
10·00 S.- " 24	45	6	4	June 11, '15	24 31	G. W. Coltham.
5·30 S., 8·00 W.-NE. cor. sec. 15	47	6	4	Sept. 5, '15	25 25	E. S. Martindale.
10·00 N.-SE. cor. sec. 6	81	6	4	Oct. 12, '15	29 20	R. H. Knight.
At " 30	81	6	4	" 24, '15	24	"
At " 22	83	6	4	Sept. 30, '15	20	"
30·00 S.- " 14	83	6	4	Oct. 3, '15	13	"
At " 11	84	6	4	Sept. 20, '15	20	"
60·00 S.- " 2	84	6	4	" 28, '15	19	"
60·00 W.- " 32	100	6	4	June 29, '14	28 09	F. V. Seibert.
45·00 W.- " 32	104	6	4	" 7, '15	55	"
At " 3	23	7	4	Oct. 5, '15	23 53	O. B. Roberts.
16·00 N.- " 18	24	7	4	" 9, '15	50	"
61·00 W.- " 35	25	7	4	" 20, '15	43	"
2·65 S.- " 4	26	7	4	" 18, '15	41	"
48·31 S.- " 2	26	7	4	" 20, '15	47	"
24·27 N.- " 10	27	7	4	" 23, '15	24 00	"
40·00 S.- " 4	27	7	4	" 26, '15	23 51	"

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
At S.E. cor. sec. 35	44	7	4	June 7, '15	25 11	G. W. Coltham.
At " 11	47	7	4	Sept. 9, '15	32	E. S. Martindale.
Sta. 20, Traverse of lake Cote, in sec. 4	54	7	4	" 29, '15	26 07	"
At NE. cor. sec. 30	77	7	4	Nov. 11, '15	27 17	E. W. Hubbell.
40·00 N.- " 28	85	7	4	Aug. 7, '15	29 11	R. H. Knight.
20·00 S.- " 17	86	7	4	" 14, '15	02	"
40·00 W.- " 15	86	7	4	" 14, '15	21	"
At " 16	86	7	4	Oct. 26, '15	29 51	E. W. Hubbell.
At " 33	87	7	4	June 21, '15	31	R. H. Knight.
20·00 S.- " 17	87	7	4	" 28, '15	27	"
28·00 N.- " 18	88	7	4	Oct. 20, '15	28 44	E. W. Hubbell.
At " 4	88	7	4	June 12, '15	29 17	R. H. Knight.
40·00 S.- " 3	23	8	4	Oct. 2, '15	23 59	O. B. Roberts.
36·00 W.- " 11	24	8	4	" 9, '15	55	"
33·18 N.- " 15	24	8	4	" 9, '15	24 03	"
35·00 N.- " 29	25	8	4	" 21, '15	23 39	"
0·40 N.- " 10	47	8	4	Sept. 13, '15	25 21	E. S. Martindale.
2·20 N., 7·65 E.-¼ cor. N. by sec. 22	53	8	4	" 23, '15	56	"
At SE. cor. sec. 3	55	8	4	Oct. 4, '15	26 26	"
0·70 S.-NE. " 19	55	8	4	" 9, '15	34	"
At " 27	76	8	4	Nov. 15, '15	30	E. W. Hubbell.
69·00 N.-SE. " 26	77	8	4	" 12, '15	28 51	"
34·33 W.-NE. " 35	104	8	4	June 11, '15	29 46	F. V. Seibert.
15·00 N.- " 24	39	9	4	July 11, '15	24 43	R. C. Purser.
1·25 W.-M. at ¼ N. by sec. 36	52	9	4	Sept. 20, '15	26 17	E. S. Martindale.
3·00 S.-NE. cor. sec. 28	57	9	4	Oct. 14, '15	35	"
12·10 N.- " 11	91	9	4	April 11, '15	30 08	L. E. Fontaine.
37·80 E.-SE. " 3	91	9	4	" 16, '15	28 57	"
65·00 E.-NE. " 17	99	9	4	Oct. 29, '15	29 00	J. W. Pierce.
45·00 E.- " 6	99	9	4	Nov. 1, '15	17	"
32·50 W.- " 33	100	9	4	July 9, '14	30 33	F. V. Seibert.
58·00 S.- " 8	101	9	4	Oct. 7, '15	32 18	E. W. Hubbell.
79·00 W.- " 35	104	9	4	June 16, '15	28 59	F. V. Seibert.
50·00 S.- " 12	104	9	4	" 23, '15	29 34	"
13·00 N.- " 1	105	9	4	" 17, '15	30 11	"
3·65 N., 3·00 E.-NE. cor. sec. 13	48	10	4	Sept. 14, '15	25 37	E. S. Martindale.
41·00 N.-NE. cor. sec. 15	57	10	4	Oct. 26, '15	26 08	"
At " 10	57	10	4	" 27, '15	19	"
Sta. 1, on lake Trav. in sec. 25	57	10	4	Nov. 1, '15	26 21	"
20·79 N.-NE. cor. sec. 25	91	10	4	April 26, '15	30 16	L. E. Fontaine.
50·00 N.- " 3	98	10	4	June 24, '15	28 19	J. W. Pierce.
45·00 N.- " 4	98	10	4	" 23, '15	26 37	"
73·00 S.- " 25	99	10	4	Sept. 15, '15	30 22	"
36·00 W.- " 36	99	10	4	" 17, '15	41	"
12·00 W.- " 33	99	10	4	" 18, '15	29 34	"
45·00 S.- " 23	99	10	4	Oct. 11, '15	03	"
48·00 E.- " 2	99	10	4	" 26, '15	28 31	"
4·00 E.-SE. " 4	99	10	4	Nov. 3, '15	30 18	"
46·00 W.-NE. " 4	99	10	4	" 4, '15	29 21	"
12·00 S.- " 15	100	10	4	Oct. 4, '15	30 19	"
80·70 W.- " 34	100	10	4	July 17, '14	29 35	F. V. Seibert.
40·00 W.- " 32	104	10	4	" 1, '15	31	"
2·00 N.- " 9	60	11	4	Nov. 18, '15	26 53	E. S. Martindale.
75·00 N.- " 13	94	11	4	Oct. 1, '15	30 51	E. W. Hubbell.
At " 15	96	11	4	" 4, '15	19	"
20·00 S.- " 12	98	11	4	Sept. 29, '15	03	J. W. Pierce.
8·60 W.- " 35	100	11	4	July 21, '14	34	F. V. Seibert.
43·73 W.- " 32	100	11	4	" 24, '14	29 33	"
24·00 S.- " 17	41	12	4	" 7, '15	24 43	R. C. Purser.
40·00 S.- " 35	87	12	4	Mar. 26, '15	29 37	L. E. Fontaine.
40·00 W.- " 32	100	12	4	July 30, '14	30 44	F. V. Seibert.
At " 30	42	13	4	Aug. 16, '14	25 23	O. B. Roberts.
On base line P. bet. lots 66 and 67, Lac La Biche settlement	67	13	4	Sept. 4, '15	27 38	P. R. A. Belanger.

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
41·00 N.-NE. cor. sec. 12, Lac La Biche settlement	67	13	4	Sept. 20, '15	27 27	P. R. A. Bélanger.
At NE. cor. sec. 9	68	13	4	" 26, '15	28 00	"
58·50 N.- " 23	87	13	4	Mar. 30, '15	11	L. E. Fontaine.
73·00 W.- " 34	100	13	4	Aug. 3, '14	31 13	F. V. Seibert.
At " 34	40	14	4	" 14, '14	25 22	O. B. Roberts.
3·00 E.-I. P. stone M. on lake shore bet. lots 50-51, Lac La Biche settlement	67	14	4	" 22, '15	28 13	P. R. A. Bélanger.
5·00 E.-P. placed on base line bet. lots 56 and 57, Lac La Biche settlement	67	14	4	" 27, '15	27 59	"
18·72 N.-NE. cor. sec. 14	87	14	4	April 1, '15	30 28	L. E. Fontaine.
3·00 S.-¼ cor. on E. by sec. 1	31	15	4	July 19, '15	24 31	R. C. Purser.
5·00 E.-P. on base line between lots 11 and 12, Lac La Biche settlement	68	15	4	" 18, '15	28 31	P. R. A. Bélanger
At NE. cor. sec. 13	13	16	4	Sept. 16, '15	22 15	W. J. Boulton
7·62 E.- " 35	14	16	4	" 14, '15	58	"
2·00 N.-¼ cor. E. by sec. 34	36	16	4	July 15, '15	24 59	R. C. Purser.
At ¼ cor. E. by sec. 19	53	16	4	Aug. 13, '15	26 14	"
9·22 N.-NE. cor. sec. 20	83	16	4	May 7, '15	31 10	L. E. Fontaine.
23·00 W.- " 32	100	16	4	Aug. 18, '14	32 34	F. V. Seibert.
65·00 W.- " 35	104	16	4	" 4, '15	33 04	"
25·00 W.- " 31	104	16	4	" 6, '15	32 48	"
71·00 N.- " 22	13	17	4	Sept. 15, '15	23 04	W. J. Boulton.
At " 31	13	17	4	" 15, '15	10	"
10·58 N, 54·55 E. NE. cor. sec. 1	33	17	4	Oct. 11, '15	24 14	R. C. Purser.
7·34 N.-NE. cor. sec. 8	79	17	4	May 25, '15	28 57	L. E. Fontaine.
4·81 S.- " 16	80	17	4	" 20, '15	30 45	"
40·98 S.- " 10	82	17	4	" 15, '15	12	"
1·00 S.- " 24	83	17	4	Mar. 10, '15	55	"
10·00 N.- " 11	84	17	4	May 12, '15	44	"
33·00 E.- " 8	58	18	4	Sept. 29, '15	26 57	H. M. R. Soars.
25·00 N.- " 23	59	18	4	" 20, '15	53	"
0·92 S.-SE. " 1	79	18	4	May 28, '15	29 33	L. E. Fontaine.
20·00 W.-NE. " 36	100	18	4	Aug. 24, '14	31 56	F. V. Seibert.
8·43 W.- " 33	100	18	4	" 25, '14	30 31	"
25·00 W.- " 33	104	18	4	" 19, '15	32 18	"
24·00 N.- " 5	7	19	4	June 22, '15	22 53	W. J. Boulton.
5·00 S., 17·00 E.-NE. cor. sec. 16	7	19	4	July 8, '15	22 44	"
At " 8	7	19	4	" 11, '15	55	"
7·50 E., 23·00 S.- " 10	11	19	4	Aug. 23, '15	47	"
36·00 W., 33·00 S.- " 30	12	19	4	Sept. 9, '15	21 59	"
At NE. cor. sec. 36	13	19	4	" 11, '15	54	"
33·00 E.- " 32	49	19	4	" 7, '15	26 24	H. M. R. Soars.
18·00 W.- " 11	52	19	4	July 27, '15	53	R. C. Purser.
50·00 E.- " 19	57	19	4	Oct. 9, '15	35	H. M. R. Soars.
At " 13	57	19	4	" 18, '15	45	"
5·00 E.- " 27	58	19	4	Sept. 27, '15	51	"
25·52 W.- " 31	100	19	4	Aug. 29, '14	31 53	F. V. Seibert.
40·00 N., 52·00 W.-NE. cor. sec. 8	7	20	4	July 12, '15	22 44	W. J. Boulton.
21·00 W., 34·00 N.-SE. " 5	7	20	4	June 29, '15	51	"
0·80 E., 6·50 N.-NE. " 9	8	20	4	July 3, '15	55	"
12·00 S., 19·50 E.- " 16	9	20	4	June 4, '15	23 09	"
2·50 E., 3·50 S.- " 21	12	20	4	Aug. 31, '15	05	"
40·00 N.- " 4	12	20	4	Sept. 6, '15	22 58	"
4·50 E., 6·50 S.- " 8	13	20	4	" 4, '15	23 12	"
54·00 W., 20·00 S.- " 18	14	20	4	" 22, '15	08	"
40·00 N.-NE. cor. sec. 15	14	20	4	" 24, '15	35	"
13·00 N.- " 33	49	20	4	Aug. 28, '15	26 32	H. M. R. Soars.
40·00 SW.- " 3	50	20	4	" 26, '15	26	"
20·00 NE.- 17	50	20	4	" 30, '15	29	"
45·00 NW.- " 31	53	20	4	Oct. 28, '15	33	"
27·00 S.- " 2	70	20	4	Sept. 30, '15	28 07	H. E. Pearson.
27·00 S.- " 2	70	20	4	Oct. 4, '15	27 56	"

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
15·00 W.-N.E. cor. sec. 29	72	20	4	Oct. 8, '15	28 45	H. E. Pearson.
15·00 N.- " 18	72	20	4	" 11, '15	29 27	"
10·00 S.- " 20	72	20	4	" 9, '15	16	"
10·00 N.- " 16	72	20	4	" 16, '15	18	"
18·00 S.- " 27	72	20	4	" 16, '15	18	"
20·00 N.- " 10	72	20	4	" 22, '15	28 59	"
35·30 W.- " 31	104	20	4	Sept. 1, '15	32 08	F. V. Seibert.
75·00 W., 5·00 S.-¼ sec. cor. E. by sec. 19	7	21	4	July 16, '15	22 50	W. J. Boulton.
67·10 W.-NE. cor. sec. 10	10	21	4	Aug. 15, '15	23 45	"
At " 34	12	21	4	Sept. 21, '15	22 41	"
40·00 W.- " 3	13	21	4	" 21, '15	23 28	"
41·00 N.- " 22	14	21	4	" 25, '15	23	"
15·00 S.- " 16	31	21	4	Oct. 3, '15	25 09	R. C. Purser.
26·00 W.- " 10	31	21	4	" 6, '15	49	"
15·00 SE.- " 8	49	21	4	Aug. 7, 15'	26 30	H. M. R. Soars.
13·00 E.-¼ P. E. by sec. 15	49	21	4	" 14, '15	41	"
55·00 N.-NE. cor. sec. 13	49	21	4	" 20, '15	33	"
20·00 SE. " 29	50	21	4	Mar. 15, '15	16	"
15·00 N., 30·00 E.-NE. cor. sec. 16	50	21	4	" 22, '15	46	"
40·00 N.W-NE. cor. sec. 21	50	21	4	" 25, '15	38	"
15·00 N.- " 8	50	21	4	April 4, '15	37	"
40·00 S.- " 6	50	21	4	Mar. 27, '15	34	"
25·00 S.-NW. " 7	50	21	4	" 27, '15	42	"
10·00 N., 40·00 W.-NE. cor. sec. 5	53	21	4	Oct. 26, '15	27 12	"
46·00 E.-NE. cor. sec. 12	54	21	4	" 22, '15	26 58	"
At " 27	72	21	4	Aug. 25, '15	28 41	H. E. Pearson.
25·00 N.- " 32	72	21	4	" 28, '15	26	"
At " 31	72	21	4	" 30, '15	11	"
10·00 N.- " 17	72	21	4	Sept. 3, '15	33	"
60·00 N.- " 7	73	21	4	Aug. 11, '15	29	"
10·00 S.- " 29	73	21	4	" 14, '15	02	"
25·00 S.- " 35	73	21	4	" 20, '15	02	"
42·40 W.- " 33	104	21	4	Sept. 6, '15	31 20	F. V. Seibert.
16·50 W.- " 31	104	21	4	" 7, '15	30 45	"
32·00 N.-¼ cor. E. by sec. 17	31	22	4	Oct. 7, '15	25 00	R. C. Purser.
20·00 S.-NE. cor. sec. 21	48	22	4	July 22, '15	26 08	H. M. R. Soars.
40·00 NE.- " 10	48	22	4	" 29, '15	15	"
25·00 NE.- " 7	48	22	4	" 31, '15	16	"
40·00 NE.- " 7	48	22	4	" 31, '15	18	"
20·00 NW.- " 19	48	22	4	Aug. 2, '15	14	"
15·00 W.- " 23	49	22	4	July 15, '15	05	"
40·00 W.- " 31	49	22	4	" 15, '15	00	"
40·00 W.- " 18	50	22	4	June 15, '15	19	"
25·00 NW.- " 18	50	22	4	" 1, '15	11	"
20·00 E.- " 24	50	22	4	" 16, '15	09	"
At ¼ P.E. by sec. 28	50	22	4	" 18, '15	32	"
40·00 S.-NE. cor. sec. 28	50	22	4	" 18, '15	20	"
30·00 S.- " 8	50	22	4	" 23, '15	50	"
40·00 S.- " 16	50	22	4	" 22, '15	30	"
40·00 W.- " 9	50	22	4	" 21, '15	12	"
40·00 NW.- " 7	50	22	4	" 28, '15	02	"
38·00 S.- " 19	51	22	4	May 22, '15	14	"
25·00 S.- " 28	51	22	4	" 27, '15	28	"
At " 31	54	22	4	Nov. 6, '15	39	"
40·00 S.- " 19	73	22	4	July 19, '15	28 07	H. E. Pearson.
7·00 S.- " 27	73	22	4	" 27, '15	34	"
At " 21	73	22	4	" 27, '15	28	"
20·00 S.- " 26	73	22	4	Aug. 3, '15	55	"
17·00 S.- " 14	73	22	4	" 6, '15	31	"
56·00 E.- " 11	73	22	4	" 9, '15	38	"
20·00 SW.- " 18	48	23	4	July 7, '15	26 10	H. M. R. Soars.
40·00 W.- " 7	48	23	4	" 7, '15	10	"
20·00 S.- " 21	48	23	4	" 23, '15	25 59	"
40·00 NW.- " 7	49	23	4	" 2, '15	26 11	"
10·00 W.- " 23	49	23	4	" 10, '15	15	"

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
14·00 N.-N.E. cor. ecs. 13	49	23	4	July 2, '15	26 12	H. M. R. Soars.
10·00 W.- " 23	49	23	4	" 1, '15	10	"
20·00 SW.- " 5	49	23	4	" 8, '15	07	"
15·00 W.- " 23	49	23	4	" 12, '15	04	"
At " 30	50	23	4	June 8, '15	33	"
10·00 W.-SE. ¼ " 8	50	23	4	" 9, '15	24	"
25·00 E.-NE. " 8	51	23	4	May 31, '15	16	"
40·00 S.- " 1	54	23	4	Nov. 12, '15	45	"
8·00 E.- " 23	55	23	4	Aug. 6, '15	56	R. C. Purser.
55·00 E.- " 19	73	23	4	June 23, '15	29 24	H. E. Pearson.
40·00 N.- " 4	73	23	4	" 29, '15	13	"
60·00 N.- " 11	73	23	4	July 12, '15	28 36	"
33.14 S.- " 1	73	23	4	Sept. 5, '15	51	L. E. Fontaine.
22·00 W.- " 31	100	23	4	" 28, '14	31 24	F. V. Seibert.
1·50 W.- " 33	104	23	4	" 16, '15	28	"
6·00 W.-NW. " 31	104	23	4	" 18, '15	11	"
73·00 N.-NE. " 34	72	24	4	June 5, '15	30 00	H. E. Pearson.
1·50 S.- " 15	73	24	4	Aug. 30, '15	29 45	L. E. Fontaine.
20·00 E.- " 18	73	24	4	June 3, '15	28	H. E. Pearson.
At " 4	73	24	4	" 5, '15	48	"
55·00 N.- " 11	73	24	4	" 12, '15	43	"
46·00 E.- " 11	73	24	4	" 15, '15	19	"
60·00 W.- " 32	100	24	4	Oct. 5, '14	30 57	F. V. Seibert.
30·00 W.- " 33	104	24	4	Sept. 21, '15	31 25	"
1·26 N.- " 18	80	25	4	Jan. 8, '15	29 16	P. R. A. Bélanger.
5·00 N.-SE. " 2	1	26	4	July 25, '15	23 38	C. M. Walker.
20·00 E.-NE. " 21	81	26	4	Jan. 14, '15	29 11	P. R. A. Bélanger.
35·00 E., 12·50 N.-¼ cor. E. by. sec. 32	18	29	4	Oct. 14, '15	24 24	W. J. Boulton.
19·50 E., 1·50 S.-NE. cor. sec. 35	23	1	5	" 23, '15	24 58	"
15·40 E.-NE. cor. sec. 31	96	1	5	July 20, '15	30 50	J. A. Fletcher.
52·10 E.- " 34	96	1	5	" 22, '15	36	"
54·30 W.- " 35	92	2	5	Aug. 10, '15	44	"
59·50 E.- " 34	96	2	5	July 19, '15	33	"
20·00 NE. " 14	51	3	5	Nov. 26, '15	26 50	H. M. R. Soars.
At " 16	58	3	5	" 18, '15	57	"
10·00 N.-¼ cor. E. by sec. 15	58	3	5	" 19, '15	59	"
At NE. cor. sec. 21	58	3	5	" 20, '15	58	"
At " 21	58	3	5	" 22, '15	34	"
35·00 NW.- " 15	58	3	5	" 22, '15	39	"
31·10 E.- " 32	96	3	5	July 13, '15	31 01	J. A. Fletcher.
4·00 N.- " 9	53	4	5	Aug. 3, '15	27 00	R. C. Purser.
9·30 E.- " 35	92	4	5	" 19, '15	31 31	J. A. Fletcher.
34·70 W.- " 34	92	5	5	" 27, '15	30 48	"
At " 31	108	5	5	Feb. 15, '15	32 41	P. M. H. LeBlanc.
5·00 W.- " 22	108	5	5	" 18, '15	34	"
18·50 N.- " 8	108	5	5	" 25, '15	03	"
2·00 N.- " 14	108	5	5	" 27, '15	31 29	"
2·00 N.- " 14	108	5	5	" 27, '15	31	"
2·00 N.- " 14	108	5	5	" 27, '15	31	"
28·00 N.- " 6	108	5	5	Mar. 17, '15	41	"
28·00 N.- " 6	108	5	5	" 17, '15	41	"
7·00 S.- " 4	65	6	5	July 12, '15	27 40	A. Lighthall.
1·84 S.- " 2	65	6	5	" 19, '15	51	"
75·00 N.- " 21	65	6	5	Aug. 1, '15	28 21	"
39·70 N.- " 3	65	6	5	July 13, '15	27 56	"
59·90 E.- " 10	65	6	5	" 20, '15	55	"
62·00 N.- " 30	65	6	5	" 28, '15	28 21	"
3·20 E.- " 35	65	6	5	" 30, '15	21	"
1·00 N.- " 28	76	6	5	Aug. 14, '15	30 53	G. J. Lonergan.
2·00 N.- " 17	77	6	5	" 13, '15	31 01	"
12·96 S.- " 4	63	7	5	Nov. 3, '15	27 38	L. E. Fontaine.
76·10 S.- " 21	63	7	5	Aug. 31, '15	23	A. Lighthall.
75·40 W.- " 30	63	7	5	Sept. 4, '15	33	"
3·20 N.- " 7	63	7	5	" 8, '15	24	"
58·60 W.- " 18	63	7	5	" 9, '15	26 43	"
27·60 E.- " 11	63	7	5	" 18, '15	27 49	"

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
80·20 S.-NE. cor. sec. 2	63	7	5	Sept. 20, '15	27 42	A. Lighthall.
20·00 S.- " 34	63	7	5	" 1, '15	17	"
18·00 N.- " 20	63	7	5	" 2, '15	14	"
70·10 S.- " 10	63	7	5	" 10, '15	23	"
71·70 S.- " 11	63	7	5	" 18, '15	42	"
42·80 S.- " 17	64	7	5	Aug. 23, '15	26 52	"
50·00 N.- " 31	64	7	5	June 9, '15	27 59	"
6·36 S.- " 32	64	7	5	" 18, '15	55	"
78·90 S.- " 7	64	7	5	Aug. 20, '15	05	"
0·87 N.- " 4	65	7	5	June 10, '15	28 14	"
6·77 N.- " 11	65	7	5	" 23, '15	14	"
At " 24	65	7	5	July 22, '15	15	"
21·00 W.- " 34	65	7	5	Aug. 10, '15	22	"
60·00 W.- " 33	65	7	5	" 11, '15	26	"
61·60 N.- " 27	65	7	5	" 6, '15	20	"
40·50 W.- " 19	65	7	5	" 10, '15	33	"
6·50 W.- " 31	92	7	5	Sept. 10, '15	29 54	J. A. Fletcher.
50·70 E.- " 36	96	7	5	June 25, '15	30 16	"
At " 16	61	8	5	Sept. 27, '15	27 30	A. Lighthall.
16·70 E.- " 11	61	8	5	" 30, '15	28 14	"
64·90 E.- " 18	61	8	5	Oct. 6, '15	27 57	"
28·80 E.- " 19	61	8	5	" 7, '15	06	"
75·60 N.- " 26	61	8	5	" 12, '15	56	"
70·10 E.- " 5	61	8	5	Sept. 30, '15	49	"
13·60 S.- " 34	61	8	5	Oct. 28, '15	44	L. E. Fontaine.
50·00 E.- " 9	62	8	5	" 16, '15	28 05	A. Lighthall.
77·40 E.- " 16	62	8	5	" 26, '15	27 26	"
52·90 E.- " 15	62	8	5	" 27, '15	30	"
74·70 N.- " 27	62	8	5	Nov. 3, '15	45	"
59·60 N.- " 6	62	8	5	Oct. 23, '15	26	"
47·40 E.- " 21	62	8	5	" 27, '15	30	"
44·70 N.- " 28	62	8	5	Nov. 5, '15	42	"
18·80 E.- " 34	96	8	5	June 21, '15	31 21	J. A. Fletcher.
60·00 N.- " 10	41	9	5	July 9, '15	27 44	A. L. Cumming.
15·00 N.- " 11	41	9	5	" 15, '15	44	"
At " 14	41	9	5	" 19, '15	34	"
60·00 N.- " 10	41	9	5	" 20, '15	43	"
25·00 E.- " 21	41	9	5	" 21, '15	39	"
48·00 W.- " 27	41	9	5	" 23, '15	37	"
43·00 N.- " 28	41	9	5	" 24, '15	31	"
34·00 N.- " 27	41	9	5	" 26, '15	40	"
55·00 N.- " 26	41	9	5	" 27, '15	34	"
72·00 E.- " 32	41	9	5	" 30, '15	31	"
60·00 W.- " 29	41	9	5	Aug. 3, '15	30	"
40·00 E.- " 20	41	9	5	" 5, '15	39	"
5·00 N.- " 30	41	9	5	" 6, '15	27	"
28·00 W.- " 19	41	9	5	" 9, '15	27	"
20·00 W.- " 18	41	9	5	" 16, '15	18	"
75·20 E.- " 12	61	9	5	Oct. 6, '15	26 56	A. Lighthall.
67·20 S.- " 25	63	9	5	Nov. 2, '15	27 41	"
52·30 S.- " 13	63	9	5	" 3, '15	05	"
49·10 S.- " 13	64	9	5	Oct. 31, '15	28 31	"
38·00 S.- " 1	64	9	5	Nov. 1, '15	06	"
37·43 E.- " 34	102	9	5	Aug. 28, '15	30 09	P. M. H. LeBlanc.
0·25 S.- " 36	102	9	5	" 29, '15	29 59	"
40·50 S.-NW. " 34	102	9	5	Sept. 7, '15	30 27	"
4·10 W.-SE. " 2	103	9	5	" 13, '15	05	"
4·35 W.- " 2	103	9	5	" 28, '15	07	"
51·33 E.-NE. " 10	103	9	5	Sept. 4, '15	28	"
10·25 N.-¼ sec. cor. S. by sec. 2	103	9	5	" 5, '15	18	"
24·80 N.-NE. cor. sec. 12	104	9	5	Aug. 19, '15	31 11	"
69·75 S.- " 1	104	9	5	" 22, '15	09	"
25·00 W.- " 35	39	10	5	Sept. 29, '15	27 20	A. L. Cumming.
At " 23	39	10	5	Oct. 22, '15	21	"
At " 14	39	10	5	" 23, '15	08	"
At " 14	39	10	5	" 23, '15	10	"

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
49·53 W.-N.E. cor. sec. 35.	39	10	5	Oct. 30, '15	27 24	A. L. Cumming.
23·25 S.- " 9.	40	10	5	" 28, '15	19	"
At " 4.	41	10	5	June 4, '15	18	"
At " 16.	41	10	5	" 7, '15	11	"
10·00 E.- " 17.	41	10	5	" 8, '15	15	"
25·00 E.- " 5.	41	10	5	" 10, '15	25	"
15·00 W.- " 9.	41	10	5	" 11, '15	26	"
18·00 N.- " 8.	41	10	5	" 12, '15	04	"
25·00 N.- " 27.	41	10	5	" 14, '15	20	"
60·00 N.- " 23	41	10	5	" 15, '15	24	"
20·00 N.- " 1.	41	10	5	May 22, '15	34	"
32·00 N.- " 13.	41	10	5	" 24, '15	24	"
30·00 N.- " 2	41	10	5	" 26, '15	27	"
35·00 N.- " 11	41	10	5	" 27, '15	28	"
4·00 W.- " 23	41	10	5	" 29, '15	21	"
63·00 E.- " 3.	41	10	5	June 1, '15	29	"
10·00 W.- " 11.	41	10	5	" 1, '15	22	"
At " 15.	41	10	5	" 3, '15	21	"
10·00 W.- " 27.	41	10	5	" 18, '15	28	"
57·00 W.- " 34.	41	10	5	" 21, '15	14	"
5·00 W.- " 33.	41	10	5	" 22, '15	17	"
5·00 W.- " 31.	41	10	5	" 23, '15	11	"
34·00 E.- " 6.	41	10	5	Aug. 13, '15	21	"
30·00 W.- " 6.	41	10	5	" 17, '15	22	"
3·00 S.- " 30.	41	10	5	" 21, '15	15	"
16·00 W.- " 31.	41	10	5	" 21, '15	10	"
66·70 W.- " 36.	92	10	3	Sept. 22, '15	31 32	J. A. Fletcher.
32·00 E.- " 33.	96	10	5	June 3, '15	26	"
35·10 N.- " 12.	101	10	5	July 31, '15	30 51	P. M. H. LeBlanc.
9·30 N.- " 13.	101	10	5	" 31, '15	54	"
21·40 S.- " 25.	101	10	5	Aug. 4, '15	31 10	"
38·20 N.- " 1.	102	10	5	" 7, '15	22 00	"
35·00 S.- " 36.	103	10	5	July 21, '15	30 59	"
35·70 S.- " 29.	104	10	5	June 30, '15	31 38	"
At " 35.	108	10	5	Mar. 27, '15	14	"
5·00 N.- " 5.	109	10	5	April 1, '15	28	"
30·00 S.- " 35.	40	11	5	Aug. 27, '15	27 21	A. L. Cumming.
45·00 E.- " 23.	40	11	5	" 28, '15	23	"
45·00 W.- " 35.	40	11	5	" 30, '15	21	"
22·00 N.- " 22.	40	11	5	" 31, '15	20	"
25·00 E.- " 28.	40	11	5	Sept. 2, '15	12	"
72·00 S.- " 29.	40	11	5	" 6, '15	19	"
65·00 W.- " 21.	40	11	5	" 7, '15	21	"
15·00 W.- " 20.	40	11	5	" 8, '15	16	"
35·00 E.- " 30.	40	11	5	" 10, '15	17	"
32·00 E.-NW. " 19.	40	11	5	" 16, '15	13	"
30·00 E.-NE. " 16.	40	11	5	" 18, '15	18	"
At " 15.	40	11	5	" 20, '15	17	"
20·00 S.- " 10.	40	11	5	" 21, '15	16	"
50·00 S.- " 14	40	11	5	" 24, '15	13	"
70·00 S.- " 2	40	11	5	" 25, '15	14	"
9·00 N.-SE. " 1.	40	11	5	" 28, '15	25	"
30·00 S.-NE. " 19.	41	11	5	" 14, '15	15	"
10·00 E.- " 12.	41	11	5	Aug. 18, '15	20	"
45·00 N.- " 13.	41	11	5	" 19, '15	20	"
35·00 N.- " 25.	41	11	5	" 23, '15	15	"
38·00 E.- " 30.	41	11	5	" 24, '15	19	"
60·20 W.- " 34.	92	11	5	Sept. 29, '15	30 31	J. A. Fletcher.
39·00 W.- " 32	92	11	5	" 20, '15	23	"
2·50 S.- " 17.	108	11	5	May 16, '14	32 41	P. M. H. LeBlanc.
50·00 N.- " 9.	108	11	5	Oct. 8, '14	48	"
At " 20.	109	11	5	Feb. 3, '15	34 01	"
43·00 W.- " 35.	92	12	5	Oct. 2, '15	30 29	J. A. Fletcher.
17·00 W.- " 31.	92	12	5	" 6, '15	31 18	"
19·40 E.- " 34.	96	12	5	May 22, '15	30 13	"

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
0·14 S.-N.E. cor. sec. 11	108	12	5	May 9, '14	32 14	P. M. H. LeBlanc.
At " 16	109	12	5	Jan. 12, '15	34 55	"
10·00 S.- " 22	109	12	5	" 15, '15	49	"
At " 14	109	12	5	" 16, '15	58	"
8·00 N.- " 22	109	12	5	April 6, '15	47	"
60·00 S.- " 28	72	13	5	Oct. 22, '15	29 26	D. F. McEwen.
Sta. 22 of trav. in sec. 25	72	13	5	Nov. 8, '15	27	"
10·00 S.-NE. cor. sec. 29	72	13	5	Oct. 16, '15	26	"
10·00 S.- " 20	72	13	5	" 18, '15	26	"
10·00 E.- " 21	72	13	5	" 21, '15	21	"
49·00 S.- " 22	72	13	5	" 27, '15	06	"
21·70 W.- " 32	92	13	5	" 12, '15	31 36	J. A. Fletcher.
47·40 E.- " 33	96	13	5	May 18, '15	29 23	"
At " 2	71	14	5	Oct. 13, '15	30	D. F. McEwen.
6·00 N.-SE. " 3	71	14	5	" 12, '15	40	"
50·00 E.-NE. " 31	71	14	5	Sept. 28, '15	33	"
30·00 S.- " 33	71	14	5	" 29, '15	36	"
35·00 S.- " 17	71	14	5	Oct. 2, '15	18	"
8·00 W.- " 8	71	14	5	" 5, '15	15	"
65·00 S.- " 28	71	14	5	" 6, '15	30	"
60·00 S.- " 27	71	14	5	" 7, '15	29	"
At " 10	71	14	5	" 8, '15	28	"
Sta. 62 of trav. in sec. 19	71	14	5	Nov. 22, '15	49	"
20·00 E.-NE. cor. sec. 6	71	14	5	Sept. 29, '15	36	"
5·00 W.-NE. cor. sec. 20	71	14	5	Oct. 1, '15	29 46	"
4·00 S.- " 7	71	14	5	" 2, '15	46	"
20·00 W.- " 18	71	14	5	" 5, '15	42	"
10·00 W.- " 16	71	14	5	" 6, '15	39	"
25·00 S.- " 21	71	14	5	" 7, '15	38	"
35·00 S.- " 4	71	14	5	" 11, '15	40	"
30·00 E.- " 22	71	14	5	" 12, '15	44	"
30·00 S.- " 23	71	14	5	" 13, '15	34	"
72·00 S.- " 25	72	14	5	" 20, '15	19	"
9·20 W.- " 34	92	14	5	" 15, '15	30 52	J. A. Fletcher.
30·00 E.- " 8	104	14	5	Aug. 28, '14	32 39	P. M. H. LeBlanc.
29·00 S.- " 22	107	14	5	May 28, '14	34 17	"
At " 7	107	14	5	June 10, '14	12	"
10·00 S.-¼ sec. cor. E. by sec. 6	107	14	5	Sept. 25, '14	02	"
50·00 N.-NE. cor. sec. 20	108	14	5	" 23, '15	19	"
30·00 W.-SE. " 7	26	15	5	July 27, '15	26 16	N. C. Stewart.
40·00 W.-SE. " 17	26	15	5	" 30, '15	01	"
30·00 S.-NE. " 24	71	15	5	" 26, '15	29 38	D. F. McEwen.
Sta. 75 of trav. in sec. 25	71	15	5	Nov. 23, '15	46	"
Sta. 96 " 35	71	15	5	" 24, '15	51	"
Sta.112 " 35	71	15	5	" 25, '15	50	"
15·00 N.-NE. cor. sec. 9	71	15	5	Sept. 21, '15	34	"
25·00 N.- " 13	71	15	5	" 25, '15	29	"
30·00 N.- " 1	71	15	5	" 27, '15	34	"
20·00 E.- " 12	71	15	5	Oct. 4, '15	43	"
42·50 E.- " 15	71	15	5	Sept. 22, '15	43	"
60·00 S.- " 33	72	15	5	Aug. 20, '15	30 05	"
50·00 S.- " 3	72	15	5	Sept. 8, '15	29 51	"
Sta. 144 of trav. in sec. 10	72	15	5	Nov. 27, '15	48	"
Sta. 164 " 15	72	15	5	" 29, '15	50	"
Sta. 221 " 32	72	15	5	Dec. 3, '15	36	"
53·50 W.-NE. cor. sec. 35	92	15	5	Oct. 19, '15	31 02	J. A. Fletcher.
42·10 E.- " 32	96	15	5	May 7, '15	30 33	"
25·70 E.- " 36	96	15	5	" 10, '15	56	"
15·60 W.- " 35	105	15	5	July 11, '14	34 15	P. M. H. LeBlanc.
2·00 N.- " 25	106	15	5	Sept. 18, '15	08	"
30·00 N.- " 20	106	15	5	Aug. 23, '14	33 30	"
20·00 S.- " 3	107	15	5	Oct. 10, '14	35 51	"
10·00 N.- " 17	108	15	5	Dec. 19, '14	34 31	"
At " 21	108	15	5	" 28, '14	41	"
20·00 N.- " 14	108	15	5	Jan. 4, '15	40	"
12·50 N.-SE. " 4	25	16	5	July 5, '15	26 18	N. C. Stewart.

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
51·00 E.-NE. cor. sec. 4.	25	16	5	July 7, '15	26 30	N. C. Stewart.
At SW. " 26.	25	16	5	" 16, '15	27	"
62·00 E.-NE. " 22.	25	16	5	" 17, '15	32	"
5·00 S.- " 26.	25	16	5	" 20, '15	25 55	"
At " 35.	25	16	5	" 22, '15	26 01	"
29·00 W.-SE. " 1.	26	16	5	" 15, '15	04	"
At NE. " 1.	26	16	5	" 26, '15	25 54	"
4·00 S.- " 1.	26	16	5	" 29, '15	26 28	"
0·50 S.- " 31.	71	16	5	Sept. 24, '15	29 07	L. E. Fontaine.
At " 34.	71	16	5	Aug. 4, '15	40	D. F. McEwen.
25·00 S.- " 30.	71	16	5	" 5, '15	32	"
At " 6.	72	16	5	July 11, '15	12	"
At " 6.	72	16	5	" 11, '15	05	"
At " 13.	72	16	5	Sept. 20, '15	35	L. E. Fontaine.
25·00 W.- " 36.	92	16	5	Oct. 21, '15	31 32	J. A. Fletcher.
0·60 N.- " 36.	105	16	5	July 20, '14	34 50	P. M. H LeBlanc.
20·00 S.- " 13.	106	16	5	" 20, '14	38	"
25·00 S.- " 33.	108	16	5	Oct. 15, '14	21	"
At " 24.	108	16	5	" 15, '14	39	"
At " 12.	24	17	5	June 14, '15	25 41	N. C. Stewart.
22·00 E.- " 12.	24	17	5	" 15, '15	26 18	"
At " 12.	24	17	5	" 22, '15	25 27	"
30·00 E.- " 19.	71	17	5	July 1, '15	29 23	D. F. McEwen.
5·00 W.- " 29.	72	17	5	June 9, '15	21	"
Sta. 46 of trav. in sec. 28.	72	17	5	Dec. 7, '15	31	"
8·40 N.-NE. cor. sec. 23.	72	17	5	Sept. 26, '15	24	L. E. Fontaine.
33·60 W.- " 36.	92	17	5	Oct. 25, '15	31 13	J. A. Fletcher.
65·30 W.- " 33.	92	17	5	" 29, '15	04	"
52·80 E.- " 35.	96	17	5	May 2, '15	33 03	"
1·00 S.- " 23.	108	17	5	Oct. 31, '14	34 59	P. M. H. LeBlanc.
1·00 S.- " 23.	108	17	5	" 31, '14	58	"
1·00 S.- " 23.	108	17	5	" 31, '14	35 01	"
1·00 S.- " 23.	108	17	5	" 31, '14	04	"
29·00 E.- " 9.	108	17	5	Nov. 6, '14	19	"
32·50 S.- " 19.	108	17	5	" 17, '14	34 21	"
56·10 N.- " 10.	109	17	5	April 12, '15	33 19	"
56·10 N.- " 10.	109	17	5	" 13, '15	14	"
2·75 N.-¼ cor. E. by sec. 31.	109	17	5	May 26, '15	32 16	"
1·50 S.- " 36.	109	17	5	" 30, '15	33 15	"
73·00 S.-NE. cor. sec. 12.	72	18	5	June 24, '15	29 31	D. F. McEwen.
5·00 S.- " 26.	108	18	5	Nov. 20, '14	33 34	P. M. H. LeBlanc.
3·50 N.-SE. " 1.	109	18	5	April 24, '15	30	"
3·50 N.- " 1.	109	18	5	" 23, '15	52	"
3·50 N.- " 1.	109	18	5	" 25, '15	25	"
3·50 N.- " 1.	109	18	5	" 26, '15	32 33	"
22·00 N.-NE. " 28.	109	18	5	May 17, '15	33 14	"
At " 31.	109	18	5	" 12, '15	32 42	"
20·30 S.- " 27.	82	19	5	" 12, '15	30 24	J. H. Johnston.
15·60 N.- " 25.	82	19	5	" 13, '15	23	"
10·00 N.- " 28.	82	19	5	" 14, '15	15	"
50·00 E.- " 35.	82	19	5	" 27, '15	32	"
60·00 N.- " 2	83	19	5	" 31, '15	25	"
60·00 N.- " 11.	83	19	5	June 3, '15	35	"
44·00 N.- " 15.	83	19	5	" 12, '15	24	"
At " 34.	83	19	5	" 23, '15	49	"
At " 8.	83	19	5	Oct. 25, '15	41	G. J. Lonergan.
45·00 E.- " 18.	84	19	5	" 28, '15	31	"
30·00 E.- " 10.	84	19	5	June 24, '15	41	J. H. Johnston.
48·00 N.- " 10.	84	19	5	" 25, '15	53	"
20·00 E.- " 16.	84	19	5	" 26, '15	39	"
48·00 N.- " 9.	84	19	5	" 28, '15	38	"
15·00 S.- " 9.	85	19	5	July 18, '15	08	"
12·00 W.- " 8.	85	19	5	" 9, '15	25	"
60·00 N.- " 5.	85	19	5	" 13, '15	04	"
At " 20.	85	19	5	" 27, '15	17	"
At " 23.	85	19	5	" 29, '15	19	"

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
10·00 S.-N.E. cor. sec. 31	85	19	5	Aug. 3, '15	30 24	J. H. Johnston.
15·00 S.- " 5	85	19	5	Oct. 29, '15	45	G. J. Lonergan.
5·80 E.- " 14	86	19	5	Aug. 18, '15	35	J. H. Johnston.
At " 31	86	19	5	Sept. 25, '15	40	"
10·40 W.- " 36	86	19	5	" 28, '15	41	"
36·20 S.- " 29	87	19	5	" 8, '15	31 07	"
39·00 W.- " 19	87	19	5	" 9, '15	08	"
55·20 S.- " 28	87	19	5	" 10, '15	11	"
30·65 S.- " 25	108	19	5	Dec. 5, '14	33 26	P. M. H. Le Blanc.
20·00 S.- " 28	26	20	5	May 19, '15	25 48	N. C. Stewart.
10·00 E.- " 21	26	20	5	" 20, '15	52	"
47·50 E.- " 21	26	20	5	" 25, '15	56	"
Sta. 27 in sec. 26	26	20	5	" 26, '15	57	"
Sta. 1 S.-NE. cor. sec. 28	26	20	5	June 3, '15	48	"
Sta. 38 in sec. 24	26	20	5	" 4, '15	51	"
0·10 N.-NE. cor. sec. 29	71	20	5	Oct. 10, '15	30 35	L. E. Fontaine.
19·00 E.-NE. " 31	71	20	5	July 26, '15	31 01	A. E. Glover.
19·00 E.- " 30	71	20	5	" 29, '15	30 46	"
10·00 S.-NE. " 25	71	20	5	Sept. 6, '15	31 01	"
20·00 S.- " 3	71	20	5	Oct. 6, '15	30 04	"
29·70 E.- " 22	72	20	5	" 6, '15	19	L. E. Fontaine.
10·00 S.- " 26	72	20	5	May 10, '15	34	A. E. Glover.
At " 13	72	20	5	" 13, '15	47	"
15·00 E.- " 12	72	20	5	" 21, '15	43	"
At " 33	72	20	5	" 31, '15	18	"
At " 29	72	20	5	June 4, '15	08	"
10·00 N.- " 18	72	20	5	" 7, '15	02	"
At " 9	72	20	5	Aug. 28, '15	18	"
38·00 E.- " 4	72	20	5	" 30, '15	24	"
2·00 N.- " 4	72	20	5	" 31, '15	15	"
32·00 S.- " 2	72	20	5	Sept. 2, '15	33	"
5·00 S.- " 1	72	20	5	" 4, '15	31	"
21·50 N.- " 23	84	20	5	Oct. 1, '15	36	J. H. Johnston
10·80 S.- " 15	84	20	5	" 8, '15	46	"
15·20 N.- " 9	84	20	5	" 11, '15	48	"
At " 19	84	20	5	" 26, '14	43	A. L. Cumming.
75·00 N.- " 7	85	20	5	Jan. 31, '15	56	L. E. Fontaine.
9·48 N.- " 10	86	20	5	Feb. 10, '15	31 04	"
14·87 N.-SE. " 2	87	20	5	" 13, '15	30 50	"
2·00 E.-NE. " 33	91	20	5	Sept. 3, '15	32 12	J. A. Buchanan.
2·00 N.- " 15	91	20	5	" 10, '15	10	"
60·00 W.- " 27	91	20	5	" 11, '15	13	"
50·00 W.- " 22	91	20	5	" 14, '15	17	"
38·00 W.- " 25	91	20	5	" 15, '15	15	"
60·00 W.- " 13	91	20	5	" 20, '15	23	"
50·00 W.- " 3	91	20	5	" 24, '15	10	"
65·00 W.- " 12	91	20	5	" 27, '15	24	"
30·00 S.-NE. cor. sec. 17	92	20	5	Aug. 20, '15	38	"
35·00 W.- " 14	92	20	5	" 28, '15	39	"
50·00 S.- " 17	92	20	5	" 30, '15	11	"
60·00 W.- " 22	92	20	5	" 23, '15	27	"
35·00 W.- " 4	92	20	5	Sept. 1, '15	16	"
75·00 S.- " 3	92	20	5	" 4, '15	19	"
22·00 E.- " 9	27	21	5	April 23, '15	26 24	N. C. Stewart.
Point A, S.-NE. cor. sec. 1	27	21	5	May 6, '15	25 44	"
10·00 W.-NE. cor. sec. 1	27	21	5	" 12, '15	54	"
1·40 S.- " 1	71	21	5	Oct. 11, '15	30 00	L. E. Fontaine.
10·00 E.- " 31	71	21	5	July 7, '15	29 54	A. E. Glover.
20·00 E.- " 33	71	21	5	" 9, '15	30 40	"
25·00 W.- " 35	71	21	5	" 12, '15	15	"
40·00 W.- " 35	71	21	5	" 14, '15	10	"
10·00 W.- " 26	71	21	5	" 16, '15	41	"
30·00 W.- " 27	71	21	5	" 17, '15	42	"
20·00 N.- " 27	71	21	5	" 19, '15	29 36	"
At " 22	71	21	5	" 20, '15	30 35	"
30·00 S.- " 26	71	21	5	" 21, '15	42	"

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RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
40·00 S.-N-E. cor. sec. 23	71	21	2 5	July 2, '15	30 38	A. E. Glover.
50·00 S.- " 29	71	21	5	" 24, '15	29 59	"
20·00 S.- " 36	71	21	5	" 27, '15	30 23	"
24·00N– " 25	71	21	5	" 28, '15	07	"
10·00 W.. " 21	71	21	5	" 31, '15	39	"
6·00 N.- " 14	71	21	5	Aug. 2, '15	29 56	"
5·00 N.- " 13	71	21	5	" 3, '15	30 44	"
At " 13	71	21	5	" 4, '15	29 50	"
15·00 N.- " 11	71	21	5	" 6, '15	30 39	"
27·00 S.- " 11	71	21	5	" 7, '15	29 54	"
28·00 E.- " 15	71	21	5	" 9, '15	57	"
10·00 E.- " 11	71	21	5	" 13, '15	30 38	"
10·00 N.- " 3	71	21	5	" 14, '15	43	"
20·00 E.- " 4	71	21	5	" 16, '15	29 51	"
29·00 E.-SW.- " 6	71	21	5	" 17, '15	30 33	"
20·00 W.-SE. " 6	71	21	5	" 18, '15	29 50	"
30·00 E.- " 6	71	21	5	" 19, '15	30 22	"
39·00 W.-NE. " 3	71	21	5	" 23, '15	41	"
40·00 E.- " 3	71	21	5	" 24, '15	38	"
21·00 W.- " 1	71	21	5	" 25, '15	29	"
40·00 S.- " 24	72	21	5	June 9, '15	21	"
10·00 N.- " 23	72	21	5	" 12, '15	32	"
55·00 S.- " 13	72	21	5	" 14, '15	31 02	"
10·00 N.- " 1	72	21	5	" 15, '15	30 51	"
25·00 S.- " 14	72	21	5	" 18, '15	31 01	"
20·00 N.- " 2	72	21	5	" 19, '15	00	"
10·00 N.- " 27	72	21	5	" 21, '15	30 40	"
60·00 E.- " 26	72	21	5	" 22, '15	44	"
At " 22	72	21	5	" 23, '15	31	"
45·00 S.- " 22	72	21	5	" 24, '15	36	"
5·00 N.- " 10	72	21	5	" 25, '15	44	"
5·00 S.- " 10	72	21	5	" 26, '15	42	"
12·00 S.- " 18	72	21	5	July 1, '15	09	"
20·00 N.- " 18	72	21	5	June 30, '15	29 56	"
30·00 S.- " 7	72	21	5	July 3, '15	30 19	"
10·00 S.- " 6	72	21	5	" 5, '15	02	"
At " 22	82	21	5	June 18, '14	18	A. L. Cumming.
60·00 N.- " 9	82	21	5	" 23, '14	09	"
20·00 W.- " 9	82	21	5	" 25, '14	29 59	"
40·00 N.- " 29	82	21	5	July 2, '14	30 29	"
60·00 N.- " 19	82	21	5	" 13, '14	47	"
8·00 W.- " 35	82	21	5	" 29, '14	02	"
70·00 W.- " 20	82	21	5	Aug. 5, '14	24	"
56·00 W.- " 9	82	21	5	" 6, '14	03	"
6·00 E.-SE. " 3	83	21	5	" 1, '14	09	"
15·00 N.-NE. " 11	85	21	5	Jan. 30, '15	31 14	L. E. Fontaine.
10·70 N.- " 9	86	21	5	Feb. 3, '15	35	"
23·48 N.-SE. " 3	87	21	5	" 4, '15	34	"
70·00 E.-NW. " 4	90	21	5	July 26, '15	01	G. J. Lonergan.
60·00 N.-SE. " 1	90	21	5	May 17, '15	32 32	J. A. Buchanan.
35·00 S.-NE. " 21	90	21	5	" 19, '15	15	"
10·00 S.- " 13	90	21	5	" 22, '15	28	"
20·00 N.- " 15	90	21	5	" 26, '15	26	"
30·00 W.- " 24	90	21	5	" 28, '15	09	"
30·00 S.- " 17	90	21	5	June 1, '15	18	"
45·00 W.- " 15	90	21	5	" 4, '15	14	"
15·00 S.- " 13	91	21	5	" 15, '15	27	"
75·00 S.- " 12	91	21	5	" 16, '15	33	"
10·00 S.- " 4	91	21	5	" 24, '15	11	"
5·00 S.- " 5	91	21	5	" 28, '15	19	"
30·00 S.- " 6	91	21	5	" 30, '15	25	"
35·00 S.- " 7	91	21	5	July 1, '15	13	"
30·00 E.- " 22	91	21	5	" 29, '15	31 53	G. J. Lonergan.
30·00 S.- " 6	92	21	5	" 30, '15	32 21	J. A. Buchanan.
2·00 S.- " 8	92	21	5	Aug. 2, '15	24	"
2·00 S.- " 21	92	21	5	" 4, '15	19	"

RESULTS OF MAGNETIC OBSERVATIONS 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
35·00 S.-N.E. cor. sec. 33	92	21	5	Aug. 5, '15	32 18	J. A. Buchanan.
30·00 W.- " 21	92	21	5	" 9, '15	25	"
5·00 W.- " 25	92	21	5	" 10, '15	20	"
18·00 N.-SE. " 1	92	21	5	" 12, '15	25	"
1·00 W.- " 3	24	22	5	" 18, '15	26 03	N. C. Stewart.
At " 2	24	22	5	" 20, '15	05	"
43·00 S.- " 33	27	22	5	Sept. 2, '15	17	"
55·00 W.- " 27	27	22	5	" 3, '15	18	"
Sta. 115 of trav. in sec. 34	28	22	5	" 1, '15	40	"
49·00 S.-NE. cor. sec. 8	28	22	5	" 15, '15	29	"
26·00 E.- " 5	28	22	5	" 16, '15	19	"
22·00 W.- " 2	28	22	5	" 20, '15	16	"
18·00 W.- " 17	28	22	5	Oct. 2, '15	15	"
74·00 W.- " 17	28	22	5	" 4, '15	18	"
41·00 N.- " 18	28	22	5	" 5, '15	16	"
At " 17	28	22	5	" 6, '15	11	"
Sta. 20 of trav. in sec. 31	28	22	5	" 9, '15	16	"
25·50 S.-NE. cor. sec. 3	29	22	5	Sept. 21, '15	18	"
48·00 N.- " 3	29	22	5	" 22, '15	21	"
33·00 W.- " 2	29	22	5	" 23, '15	20	"
At ¼ sec. cor. N. by sec. 13	29	22	5	" 27, '15	21	"
15·00 E.-NE. cor. sec. 11	29	22	5	" 28, '15	23	"
At " 2	29	22	5	" 29, '15	12	"
20·00 S.- " 12	82	22	5	July 17, '14	30 25	A. L. Cumming.
50·00 N.- " 13	82	22	5	" 20, '14	19	"
At SE. " 6	82	22	5	Aug. 17, '14	23	"
At NE. " 4	82	22	5	" 23, '14	37	"
At " 21	82	22	5	" 24, '14	32	"
At " 10	82	22	5	" 26, '14	34	"
7·00 S.- " 11	82	22	5	" 29, '14	36	"
15·00 S.- " 26	82	22	5	Sept. 5, '14	44	"
10·00 E.- " 34	82	22	5	" 12, '14	35	"
38·00 E.- " 34	77	24	5	Jan. 9, '15	06	L. E. Fontaine.
25·00 S.- " 2	85	24	5	May 16, '15	31 40	R. V. Heathcott.
8·00 S.- " 18	85	24	5	" 23, '15	28	"
At " 5	85	24	5	" 20, '15	32 01	"
18·33 S.- " 31	77	25	5	Dec. 23, '14	29 11	L. E. Fontaine.
0·20 S.- " 19	78	25	5	" 27, '14	48	"
14·43 N.- " 10	79	25	5	Jan. 3, '15	30 27	"
30·00 E.- " 7	85	25	5	July 17, '15	31 39	G. J. Lonergan.
At " 16	85	25	5	June 7, '15	35	R. V. Heathcott.
23·00 N.- " 8	85	25	5	" 8, '15	44	"
35·00 W.- " 17	85	25	5	" 15, '15	40	"
13·00 N.- " 11	85	26	5	July 7, '15	25	G. J. Lonergan.
At " 9	49	27	5	Oct. 13, '15	27 30	M. P. Bridgland.
At " 9	49	27	5	" 13, '15	33	"
40·00 S.- " 1	49	28	5	" 13, '15	38	"
At " 2	24	1	6	" 5, '15	25 57	W. J. Johnston.
41·00 S.- " 8	45	1	6	" 3, '15	27 11	M. P. Bridgland.
41·00 S.- " 8	45	1	6	" 3, '15	10	"
40·00 W.- " 10	45	1	6	" 5, '15	13	"
40·00 W.- " 10	45	1	6	" 5, '15	13	"
37·00 W.- " 8	45	1	6	" 5, '15	19	"
37·00 W.- " 8	45	1	6	" 5, '15	19	"
3·00 E.- " 8	45	1	6	" 5, '15	16	"
3·00 E.- " 8	45	1	6	" 5, '15	15	"
20·00 S.- " 8	83	1	6	Aug. 9, '15	31 32	R. V. Heathcott.
25·00 S.- " 27	83	1	6	" 19, '15	35	"
8·00 E.- " 17	83	1	6	" 26, '15	26	"
8·00 N.- " 20	84	1	6	" 2, '15	25	"
45·00 S.- " 19	84	1	6	" 5, '15	25	"
20·00 S.- " 22	84	1	6	" 5, '15	32	"
At " 11	85	1	6	June 29, '15	32	"
At " 3	85	1	6	" 30, '15	31	"
At " 10	85	1	6	July 9, '15	41	"
12·00 S.-NE. cor. sec. 28	85	1	6	" 1, '15	31 32	"

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
15·00 N.-N.E. cor. sec. 15	85	1	6	July 3, '15	31 39	R. V. Heathcott.
5·00 E.- " 28	85	1	6	" 13, '15	25	"
5·00 W.- " 21	85	1	6	" 16, '15	35	"
64·00 N.-SE. " 12	91	1	6	April 3, '15	32 57	J. R. Akins.
7·00 N.- " 13	91	1	6	" 13, '15	33 01	"
22·84 N.-NE. " 4	93	1	6	" 28, '15	45	"
12·00 N.-SE. " 1	94	1	6	" 29, '15	57	"
12·00 N.- " 1	94	1	6	" 29, '15	53	"
20·88 S.-NE. " 24	94	1	6	May 2, '15	57	"
36·93 N.-SE. " 1	95	1	6	" 5, '15	34 04	"
21·23 N.- " 13	95	1	6	" 6, '15	05	"
0·26 N.- " 1	96	1	6	" 8, '15	25	"
51·28 N.- " 12	96	1	6	" 10, '15	22	"
53·30 N.- " 13	96	1	6	" 12, '15	26	"
79·30 N.- " 13	96	1	6	" 13, '15	33	"
28·00 N.- " 25	96	1	6	" 13, '15	48	"
21·48 N.- " 1	97	1	6	" 16, '15	35 06	"
21·48 N.- " 1	97	1	6	" 16, '15	34 57	"
7·56 S.- " 36	97	1	6	" 18, '15	38	"
At " 1	98	1	6	" 19, '15	41	"
At " 13	98	1	6	" 20, '15	51	"
7·30 S.- " 36	98	1	6	" 23, '15	35 22	"
7·30 S.- " 36	98	1	6	" 23, '15	20	"
7·30 S.- " 36	98	1	6	" 23, '15	14	"
1·00 S.- " 36	99	1	6	" 27, '15	38	"
38·38 S.- " 25	100	1	6	" 31, '15	47	"
At " 36	100	1	6	June 1, '15	36 02	"
At " 13	101	1	6	" 2, '15	35 54	"
18·69 N.- " 1	102	1	6	" 4, '15	43	"
At NE. " 1	102	1	6	" 6, '15	52	"
9·00 S.- " 1	102	1	6	" 6, '15	48	"
4·00 S.- " 25	102	1	6	" 10, '15	41	"
At " 24	103	1	6	" 16, '15	36	"
40·00 N.-SE. " 25	103	1	6	" 16, '15	29	"
3·00 N.- " 12	104	1	6	" 19, '15	21	"
40·00 S.-NE. " 36	104	1	6	" 21, '15	34 39	"
0·40 S.-SE. " 1	106	1	6	July 9, '15	20	"
0·40 S.- " 1	106	1	6	" 9, '15	20	"
28·00 N.- " 1	107	1	6	" 15, '15	33 18	"
4·00 S.-NE. " 24	107	1	6	" 18, '15	32 48	"
4·00 S.- " 24	107	1	6	" 18, '15	42	"
39·40 N.-SE. " 13	108	1	6	" 22, '15	34 08	"
12·00 S.-NE. " 36	108	1	6	" 25, '15	32 05	"
0·80 N.-SE. " 25	109	1	6	" 28, '15	07	"
At " 1	110	1	6	" 30, '15	27	"
34·74 N.- " 1	111	1	6	Aug. 4, '15	33 19	"
52·71 N.- " 36	111	1	6	" 7, '15	34 00	"
4·00 N.- " 25	113	1	6	" 16, '15	35	"
60·61 W.-NE. " 36	116	1	6	Oct. 18, '15	35 34	"
16·00 W.- " 34	116	1	6	" 19, '15	54	"
16·00 W.- " 34	116	1	6	" 19, '15	36 12	"
16·00 W.- " 34	116	1	6	" 19, '15	00	"
16·00 W.- " 34	116	1	6	" 19, '15	35 28	"
16·00 W.- " 34	116	1	6	" 19, '15	26	"
16·00 W.- " 34	116	1	6	" 19, '15	25	"
16·00 W.- " 34	116	1	6	" 19, '15	27	"
40·00 N.-SE. " 36	116	1	6	Sept. 1, '15	27	"
42·77 N.- " 1	117	1	6	" 2, '15	23	"
0·60 N.-NE. " 24	118	1	6	" 8, '15	29	"
23·60 N.-SE. " 36	119	1	6	" 14, '15	21	"
15·00 N.- " 36	120	1	6	" 17, '15	36	"
73·58 N.- " 25	122	1	6	" 25, '15	36 25	"
11·10 S.-NE. " 25	123	1	6	" 29, '15	12	"
11·10 S.- " 25	123	1	6	" 30, '15	00	"
37·00 W.- " 33	82	2	6	" 27, '15	31 06	R. V. Heathcott.
20·00 N.- " 14	83	2	6	" 7, '15	18	"

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
20·00 N.-N.E. cor. sec. 2	83	2	6	Sept. 24, '15	30 56	R. V. Heathcott.
30·00 N.- " 14	83	2	6	" 8, '15	31 15	"
At " 11	45	3	6	Oct. 10, '15	27 22	M. P. Bridgland.
At " 11	45	3	6	" 10, '15	21	"
20·00 S.- " 30	77	4	6	Aug. 21, '15	29 15	G. J. Lonergan.
At " 23	80	5	6	Oct. 15, '15	30 04	"
39·00 N.-SE. " 5	82	5	6	June 22, '15	29 21	T. A. Davies.
39·00 E.-NE. " 15	83	5	6	Aug. 28, '15	39	G. J. Lonergan.
10·00 E.- " 8	83	5	6	" 10, '15	26	T. A. Davies.
At " 4	84	5	6	Sept. 3, '15	06	G. J. Lonergan.
At " 3	84	5	6	July 5, '15	25	T. A. Davies.
At " 22	72	6	6	Oct. 31, '14	28 31	L. E. Fontaine.
At " 8	72	6	6	Nov. 2, '14	48	"
20·00 E.- " 32	76	6	6	June 10, '15	30 31	G. A. Tipper.
40·00 E.- " 31	76	6	6	" 11, '15	06	"
45·00 N.- " 22	76	6	6	" 15, '15	26	"
25·00 N.- " 23	76	6	6	" 17, '15	11	"
At " 21	76	6	6	" 18, '15	22	"
50·00 E.- " 14	76	6	6	" 21, '15	14	"
60·00 N.- " 9	76	6	6	" 22, '15	22	"
At " 15	76	6	6	" 23, '15	06	"
25·00 S.- " 2	76	6	6	" 26, '15	29 55	"
60·00 E.- " 9	76	6	6	" 26, '15	30 27	"
60·00 S.- " 3	76	6	6	" 30, '15	02	"
14·00 E.- " 18	77	6	6	" 3, '15	22	"
70·00 N.- " 2	77	6	6	" 4, '15	40	"
60·00 N.- " 14	77	6	6	" 5, '15	47	"
40·00 N.- " 15	77	6	6	" 5, '15	49	"
28·28 S.- " 24	78	6	6	Oct. 27, '14	31 02	L. E. Fontaine.
24·00 S.- " 4	81	6	6	Sept. 20, '15	03	H. S. Day.
60·00 W.- " 6	81	6	6	" 21, '15	08	"
45·00 S.- " 5	81	6	6	" 23, '15	30 32	"
35·00 W.- " 4	81	6	6	" 24, '15	31 04	"
10·00 W.- " 3	81	6	6	" 25, '15	37	"
40·00 W.- " 1	81	6	6	" 30, '15	15	"
24·00 W.- " 11	81	6	6	Oct. 1, '15	42	"
25·00 N.- " 22	82	6	6	Aug. 4, '15	29 45	"
20·00 W.- " 15	82	6	6	" 7, '15	50	"
20·00 E.- " 19	82	6	6	" 19, '15	30 04	"
At " 34	83	6	6	Sept. 1, '15	00	G. J. Lonergan.
At " 28	83	6	6	June 24, '15	01	H. S. Day.
20·00 N.- " 19	83	6	6	July 1, '15	29 41	"
10·00 N.- " 5	83	6	6	" 8, '15	30 02	"
20·00 N.- " 14	83	6	6	" 24, '15	29 53	"
10·00 N.-SE. " 3	83	6	6	" 29, '15	36	"
At NE. " 6	84	6	6	Aug. 31, '15	52	G. J. Lonergan.
28·00 S.- " 13	84	6	6	May 21, '15	37	H. S. Day.
At " 30	84	6	6	" 31, '15	29	"
At " 8	84	6	6	June 8, '15	20	"
20·00 N.- " 5	84	6	6	" 11, '15	33	"
30·00 W.- " 35	76	7	6	July 5, '15	30 21	G. A. Tipper.
40·00 E.- " 34	76	7	6	" 6, '15	31	"
At " 2	76	7	6	" 23, '15	25	"
3·00 W.- " 11	77	7	6	Aug. 16, '15	28	G. J. Lonergan.
20·00 W.- " 7	77	7	6	July 30, '15	05	G. A. Tipper.
At " 23	77	7	6	Aug. 14, '15	28	"
30·00 N.- " 23	77	7	6	" 16, '15	24	"
70·00 N.- " 21	77	7	6	" 24, '15	29 56	"
65·00 N.- " 17	78	7	6	Sept. 6, '15	31 06	"
40·00 W.- " 20	78	7	6	" 6, '15	17	"
20·00 W.- " 18	78	7	6	" 13, '15	26	"
55·00 W.- " 18	78	7	6	" 13, '15	10	"
65·00 N.- " 15	78	7	6	" 15, '15	30 42	"
At " 14	78	7	6	Aug. 27, '15	01	"
19·06 E.- " 31	18	8	6	April 26, '15	27 09	W. J. Johnston.
45·00 N.-SE. " 31	18	8	6	May 10, '15	26 31	"

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
60·00 N.- " 34	18	8	6	May 7, '15	25 40	W. J. Johnston.
18·00 N.- " 3	20	9	6	" 25, '15	26 14	"
29·00 N.-NE. " 10	21	10	6	June 12, '15	25 37	"
20·00 E.- " 10	21	10	6	" 14, '15	33	"
At NE. cor. L,S. 5 sec. 22	21	10	6	" 17, '15	33	"
31·30 E.-NE. cor. sec. 21	21	10	6	" 18, '15	22	"
40·00 N.- " 10	22	10	6	" 25, '15	42	"
60·00 N.-¼ I.P.M. N. by sec. 3	22	10	6	" 28, '15	22	"
3·00 E.-¼ sec. P. E. by sec. 19	22	10	6	July 3, '15	33	"
6·00 E.,						"
40·00 N.-NE. cor. sec. 18	22	10	6	" 2, '15	33	
40·00 S.- " 18	23	10	6	Aug. 5, '15	32	"
13·14 N.- " 22	74	10	6	Dec. 2, '14	30 38	"
10·00 N.- " 9	75	10	6	" 4, '14	55	L. E. Fontaine.
26·74 N.-¼ sec. cor. on E. by sec. 30	17	11	6	May 24, '15	26 02	"
20·77 E.-NE. cor. sec. 30	17	11	6	" 26, '15	25 28	C. H. Taggart.
53·01 E.- " 30	17	11	6	" 27, '15	16	"
70·70 E.- " 30	17	11	6	" 28, '15	33	"
6·19 S.-NE. cor. sec. 29	17	11	6	" 28, '15	26 23	"
23·88 S.- " 29	17	11	6	" 28, '15	25 16	"
48·63 S.- " 29	17	11	6	" 31, '15	58	"
60·77 S.- " 29	17	11	6	" 31, '15	26 07	"
50·60 E.- " 29	17	11	6	June 1, '15	25 55	"
61·75 E.- " 29	17	11	6	" 1, '15	51	"
20·29 W.- " 27	17	11	6	" 7, '15	26 00	"
31·93 W.- " 27	17	11	6	" 7, '15	25 39	"
43·02 W.- " 27	17	11	6	" 8, '15	41	"
55·57 W.- " 27	17	11	6	" 8, '15	26 03	"
At " 26	17	11	6	" 8, '15	25 50	"
At ¼ P. E. by sec. 28	17	11	6	" 8, '15	40	"
23·82 S.-NE. cor. sec. 24	17	11	6	" 9, '15	26 13	"
7·16 W.-SE. " 12	17	11	6	" 22, '15	25 39	"
20·28 W.- " 12	17	11	6	" 22, '15	50	"
30·00 W.- " 12	17	11	6	" 24, '15	58	"
47·11 W.- " 12	17	11	6	" 24, '15	52	"
59·45 W.- " 12	17	11	6	" 25, '15	26 09	"
4·43 W.- " 11	17	11	6	" 25, '15	25 55	"
20·27 W.- " 11	17	11	6	" 25, '15	58	"
34·43 W.- " 11	17	11	6	" 25, '15	55	"
55·04 W.- " 11	17	11	6	" 26, '15	46	"
62·84 W.- " 11	17	11	6	" 27, '15	53	"
56·08 W.- " 10	17	11	6	" 29, '15	53	"
19·02 N.-SW. " 10	17	11	6	" 30, '15	48	"
26·35 N.- " 10	17	11	6	" 30, '15	26 03	"
46·85 N.- " 10	17	11	6	July 1, '15	25 47	"
59·45 S.-NE. " 16	17	11	6	" 3, '15	59	"
53·19 N.-SW. " 10	17	11	6	" 3, '15	52	"
34·95 W.-SE. " 16	17	11	6	" 6, '15	26 03	"
53·98 W.- " 16	17	11	6	" 6, '15	25 39	"
71·23 W.- " 16	17	11	6	" 6, '15	26 35	"
43·89 W.- " 17	17	11	6	" 8, '15	11	"
49·17 W.- " 17	17	11	6	" 8, '15	22	"
69·25 W.- " 17	17	11	6	" 9, '15	09	"
3·80 W.-NE. " 31	17	11	6	Aug. 11, '15	25 40	"
13·72 W.- " 31	17	11	6	" 12, '15	49	"
0·30 E.-NW. " 31	17	11	6	" 12, '15	26 01	"
14·88 E.-NE. " 31	17	11	6	" 16, '15	25 54	"
30·99 E.- " 31	17	11	6	" 16, '15	55	"
37·58 N.-SE. " 6	18	11	6	" 11, '15	25 45	"
9·00 N.-NE. " 6	18	11	6	" 13, '15	43	"
6·76 N.- " 5	18	11	6	" 18, '15	26 27	"
6·72 W.-SE. ¼ sec. 8	18	11	6	" 19, '15	25 50	"
At SE. cor. sec. 3	23	11	6	July 7, '15	25 34	W. J. Johnston.
At NE. " 3	23	11	6	" 8, '15	28	"
At " 6	23	11	6	Aug. 20, '15	26 13	"
38·64 S.-NE. " 24	17	12	6	June 9, '15	25 56	C. H. Taggart.

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
49·67 S.-N.E. cor. sec. 24	17	12	6	June 9, '15	26 03	C. H. Taggart.
49·67 S.- " 24	17	12	6	" 10, '15	07	"
62·83 S.- " 24	17	12	6	" 10, '15	10	"
22·88 W.-SE. " 24	17	12	6	" 11, '15	25 54	"
28·43 W.- " 24	17	12	6	" 11, '15	56	"
51·43 W.- " 24	17	12	6	" 12, '15	58	"
65·14 W.- " 25	17	12	6	" 12, '15	26 04	"
16·73 W.- " 23	17	12	6	" 14, '15	03	"
27·07 W.- " 23	17	12	6	" 14, '15	13	"
39·54 W.- " 23	17	12	6	" 14, '15	18	"
24·70 N.- " 23	17	12	6	" 15, '15	07	"
34·41 N.- " 23	17	12	6	" 15, '15	02	"
49·62 N.- " 23	17	12	6	" 15, '15	25 59	"
60·00 N.- " 23	17	12	6	" 16, '15	26 11	"
22·86 N.- " 26	17	12	6	" 17, '15	26 08	"
39·29 N.- " 26	17	12	6	" 17, '15	26 07	"
11·95 N.-NE. " 26	17	12	6	" 18, '15	25 58	"
19·06 N.- " 26	17	12	6	" 18, '15	26 06	"
26·46 N.- " 26	17	12	6	" 18, '15	06	"
12·48 W.-SE. " 8	17	12	6	July 26, '15	24 16	"
1·84 W.- " 8	17	12	6	" 27, '15	25 48	"
†2·80 S.-NE. " 6	17	12	6	" 27, '15	23 05	"
15·58 W.-SE. " 6	17	12	6	" 28, '15	25 00	"
67·02 W.- " 6	17	12	6	" 29, '15	25 25	"
57·79 N.-SW. " 6	17	12	6	" 30, '15	31	"
58·43 N.-NW. " 18	17	12	6	Aug. 4, '15	24 27	"
11·20 E.- " 19	17	12	6	" 5, '15	27 00	"
25·02 E.- " 19	17	12	6	" 5, '15	25 21	"
77·18 E.- " 19	17	12	6	" 6, '15	24 13	"
NE. " 29	17	12	6	" 7, '15	26 13	"
2·08 S.- " 30	17	12	6	" 8, '15	25 24	"
At " 19	22	12	6	" 31, '15	26 49	W. J. Johnston.
At " 20	22	12	6	Sept. 1, '15	03	"
53·96 N.- " 18	70	12	6	Nov. 22, '14	30 30	L. E. Fontaine.
7·44 N.-SE. " 6	71	12	6	" 19, '14	30 39	"
71·09 S.-NE. " 29	18	13	6	Sept. 10, '15	24 21	C. H. Taggart.
69·63 N.- " 5	18	13	6	" 17, '15	09	"
7·20 E.- " 4	18	13	6	" 17, '15	21 13	"
24·37 E.- " 4	18	13	6	" 17, '15	20 59	"
63·72 E.- " 4	18	13	6	" 18, '15	21 02	"
78·58 E.- " 4	18	13	6	" 18, '15	25 39	"
73·22 E.- " 4	18	13	6	" 18, '15	27 58	"
59·44 S.- " 22	18	13	6	Aug. 23, '15	26 46	"
11·18 S.- " 15	18	13	6	" 23, '15	24 27	"
41·83 W.- " 15	18	13	6	" 24, '15	26 42	"
" 23	18	13	6	" 25, '15	25 30	"
3·23 S.- " 23	18	13	6	" 26, '15	25 11	"
62·69 S.- " 23	18	13	6	" 26, '15	24 41	"
73·56 S.- " 23	18	13	6	" 26, '15	46	"
7·31 S.- " 14	18	13	6	" 26, '15	25 29	"
4·53 W.- " 11	18	13	6	" 27, '15	20	"
34·30 E.-NW. " 14	18	13	6	" 30, '15	23 55	"
49·66 E.- " 14	18	13	6	" 31, '15	20 31	"
19·28 E.-NE. " 14	18	13	6	" 31, '15	24 51	"
36·61 E.- " 14	18	13	6	Sept. 1, '15	25 05	"
37·92 N.- " 24	18	13	6	" 3, '15	57	"
56·43 E.- " 23	18	13	6	" 4, '15	40	"
13·46 N.- " 28	18	13	6	" 6, '15	05	"
67·00 E.- " 33	18	13	6	" 7, '15	21	"
At " 24	22	13	6	Aug. 29, '15	27 21	W. J. Johnston.
20·00 N.-NE. " 13	22	13	6	" 30, '15	26 38	"
At " 24	22	13	6	" 28, '15	27 00	"
At " 1	22	13	6	Sept. 7, '15	34	"
21·63 S.- " 36	69	13	6	Nov. 25, '14	30 38	L. E. Fontaine.
5·19 N.-¼ sec. cor. on E. by sec. 6	18	15	6	May 15, '15	26 19	C. H. Taggart.
35·63 S.-NE. cor. sec. 5	18	15	6	" 16, '15	25 56	"

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RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
At ¼ sec. cor. on N. by sec. 17	18	15	6	May 16, '15	26 33	C. H. Taggart.
62·01 E.-NE. cor. sec. 15	20	15	6	Oct. 12, '15	25 56	"
5·15 S.- " 15	20	15	6	" 13, '15	24 23	"
58·75 N.- " 7	77	16	6	June 13, '15	30 20	S. D. Fawcett.
30·00 N.- " 17	80	16	6	Sept. 18, '15	30 28	G. J. Lonergan.
15·00 E.- " 17	80	16	6	" 19, '15	40	"
35·50 S.- " 21	80	16	6	" 15, '15	30 29	S. D. Fawcett.
19·45 N.- " 9	77	17	6	June 30, '15	30 22	"
32·00 N.- " 33	77	17	6	July 24, '15	13	"
At " 34	77	17	6	Oct. 4, '15	30 22	G. J. Lonergan.
60·00 E.- " 10	78	17	6	" 3, '15	30 32	"
20·00 W.- " 16	78	17	6	Aug. 8, '15	30 22	S. D. Fawcett.
20·00 E.- " 33	79	17	6	Oct. 1, '15	30 03	"
28·00 W.- " 22	80	17	6	Sept. 23, '15	30 17	"
66·00 W.- " 9	80	17	6	" 24, '15	10	"
10·00 W.- " 26	80	17	6	" 25, '15	18	"
0·75 W.-¼ sec. N. by sec. 28	82	17	6	Oct. 2, '15	31 07	L. Brenot.
At NE. cor. sec. 29	82	17	6	Sept. 30, '15	10	"
At " 27	82	17	6	Oct. 1, '15	18	"
7·00 S.- " 10	83	17	6	Aug. 30, '15	31 28	"
10·00 N.- " 5	83	17	6	" 27, '15	40	"
20·00 N.-SE. " 31	83	17	6	Sept. 7, '15	09	"
10·00 E.- " 4	83	17	6	" 30, '15	09	"
30·00 N.-NE. " 15	83	17	6	" 24, '15	31 01	G. J. Lonergan.
At " 21	83	17	6	" 25, '15	31 11	"
At " 22	84	17	6	" 26, '15	31 33	"
At " 23	84	17	6	" 15, '15	31 32	L. Brenot.
1·50 N.- " 22	84	17	6	" 19, '15	16	"
66·20 W.- " 32	19	19	6	Oct. 1, '15	26 41	C. H. Taggart.
14·70 E.- " 30	19	19	6	" 4, '15	01	"
50·60 E.- " 30	19	19	6	" 4, '15	25 51	"
6·60 E.- " 29	19	19	6	" 4, '15	52	"
14·04 E.- " SE. ¼ sec. 28	19	19	6	" 6, '15	26 07	"
22·68 S.- " 27	19	19	6	" 6, '15	09	"
66·00 N.- " 8	20	19	6	Sept. 27, '15	26 07	"
57·90 E.-½ E. by. sec. 33	22	21	6	" 29, '15	26 34	J. A. Calder.
14·60 E.-NE. cor. sec. 2	22	21	6	" 27, '15	27 54	"
30·00 E.-¼ on E. by. sec. 26	22	21	6	Oct. 4, '15	28 33	"
10·00 S.-NE. cor. sec. 8	84	22	6	Aug. 17, '15	31 32	L. Brenot.
At " 6	84	22	6	" 22, '15	37	"
25·00 S.- " 10	84	22	6	" 17, '15	10	"
73·00 N.-SE. cor. sec. 4	8	23	6	April 28, '15	26 18	P. J. McGarry.
At N.E. " 11	8	23	6	May 3, '15	26	"
At " 24	8	23	6	" 15, '15	01	"
63·00 N.- " 23	8	23	6	" 18, '15	25 56	"
75·00 N.- " 10	8	23	6	" 24, '15	55	"
78·00 E.- " 14	8	23	6	" 25, '15	51	"
¼ sec. cor. on N. by. sec. 23	8	23	6	" 26, '15	26 20	"
68·00 N.-NE. cor. sec. 3	8	23	6	" 28, '15	01	"
55·00 W.- " 10	8	23	6	" 29, '15	12	"
36·00 E.-of ¼ sec. cor. on E. by. sec. 16	8	23	6	June 1, '15	10	"
70·00 E.-NE. cor. sec. 35	8	23	6	" 7, '15	25 58	"
45·00 E.- " 24	8	23	6	" 11, '15	25 35	"
59·00 N.- " 10	9	23	6	" 22, '15	25 34	"
29·00 E.- " 11	9	23	6	" 25, '15	51	"
73·00 N.- " 14	9	23	6	July 1, '15	26 00	"
79·00 S.- " 22	9	23	6	" 5, '15	07	"
39·00 E.- " 26	9	23	6	" 9, '15	25 59	"
At " 36	9	23	6	" 21, '15	26 08	"
At " 2	9	23	6	June 8, '15	08	"
32·70 W.- " 29	15	23	6	" 15, '15	25 17	J. A. Calder.
39·90 W.- " 19	15	23	6	" 19, '15	27	"
12·00 N.-						
At centre sec. 16	15	23	6	" 21, '15	26 03	"
35·00 N.-NE. cor. sec. 30	15	23	6	" 23, '15	24 57	"
30·00 W.-						

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
35·00 E.-N.E. cor. sec. 31	15	23	6	June 24, '15	25 46	J. A. Calder.
35·00 S.-NE.						
0·90 W.- " 29	15	23	6	" 25, '15	18	"
4·20 E.-centre sec. 26	15	23	6	July 1, '15	43	"
47·00 S.-NE. cor. sec. 28	83	23	6	Aug. 1, '15	31 47	L. Brenot.
40·00 S.- " 29	83	23	6	July 29, '15	33	"
40·00 E.- " 20	83	23	6	Aug. 2, '15	36	"
At " 7	83	23	6	" 6, '15	37	"
40·00 E.- " 23	83	23	6	" 9, '15	31 37	"
2·00 W.- " 18	83	23	6	July 13, '15	21	"
At " 34	83	23	6	" 24, '15	36	"
48·00 N.- " 30	83	23	6	" 30, '15	22	"
3·00 S.- " 22	83	23	6	Aug. 7, '15	43	"
37·00 N.- " 10	83	23	6	" 9, '15	47	"
20·00 E.- " 9	83	23	6	" 11, '15	40	"
46·00 N.- " 5	83	23	6	" 12, '15	36	"
11·75 W.- " 32	15	24	6	May 1, '15	24 51	J. A. Calder.
30·00 S.- " 31	15	24	6	" 4, '15	25 05	"
41·00 W.-NE.						
0·17 S.- " 32	15	24	6	" 12, '15	27 00	"
3·70 E.- " 29	15	24	6	" 21, '15	25 13	"
11·00 S.- " 22	15	24	6	" 22, '15	27 59	"
3·00 E.-NE.						
65·00 S.- " 30	15	24	6	" 25, '15	21 22	"
1·00 E.- " 26	15	24	6	June 11, '15	25 21	"
13·00 N.-NE.						
47·20 S.- " 35	15	24	6	" 18, '15	26 31	"
5·07 S.-¼ E. by. sec. 19	16	24	6	April 20, '15	28 02	"
31·27 S.-NE. cor. sec. 7	16	24	6	" 23, '15	27 05	"
36·05 S.- " 17	16	24	6	" 26, '15	25 37	"
40·26 W.- " 6	16	24	6	May 10, '15	19 27	"
45·34 S.- " 6	16	24	6	" 11, '15	22 31	"
16·86 S.-NW. cor. Nicomen, I.R. No. 12	16	24	6	" 14, '15	29 08	"
6·40 N.-centre sec. 10	16	24	6	" 31, '15	27 01	"
6·40 N.- " 10	16	24	6	June 1, '15	02	"
2·50 S.- " 27	16	24	6	" 2, '15	28 12	"
10·00 S.-NE. cor. sec. 8	83	24	6	" 21, '15	30 48	L. Brenot.
At " 16	83	24	6	July 1, '15	31 09	"
20·00 S.- " 10	83	24	6	" 4, '15	12	"
7·00 W.- " 12	83	24	6	" 7, '15	27	"
10·00 S.- " 11	83	24	6	" 8, '15	24	"
5·00 W.- " 13	83	24	6	" 8, '15	25	"
8·00 N.- " 12	83	24	6	" 10, '15	23	"
9·50 N.- " 30	22	25	6	Aug. 19, '15	26 24	J. A. Calder.
43·40 W.- " 31	22	25	6	" 20, '15	27 11	"
40·60 W.- " 30	22	25	6	" 25, '15	26 09	"
6·00 W.-SE. " 19	22	25	6	" 27, '15	19	"
40·00 N.-SE.						
At NE. " 10	22	25	6	" 30, '15	43	"
47·80 N.- " 10	22	25	6	" 31, '15	43	"
17·00 S.-¼ N. by. sec. 34	22	25	6	Sept. 3, '15	28 51	"
42·50 S.-NE. cor. sec. 8	22	25	6	" 8, '15	26 46	"
45·00 N.- " 28	82	25	6	June 13, '15	30 36	L. Brenot.
5·20 S.-NW. " 19	19	26	6	July 12, '15	25 28	J. A. Calder.
18·30 N.- " 19	19	26	6	" 15, '15	26 08	"
51·20 E.-SW. " 6	19	26	6	" 17, '15	28 19	"
7·00 E.- " 5	19	26	6	" 20, '15	26 05	"
44·10 E.- " 4	19	26	6	" 22, '15	21 09	"
46·40 S.-NE. " 8	19	26	6	" 23, '15	26 15	"
50·30 S.- " 5	19	26	6	" 24, '15	54	"
21·00 N.-SE " 4	19	26	6	" 26, '15	27 20	"
16·90 N.-NE. " 4	19	26	6	" 29, '15	01	"
33·90 S.- " 16	19	26	6	" 30, '15	26 20	"
36·30 S.- " 28	19	26	6	Aug. 2, '15	23	"
50·40 S.- " 20	19	26	6	" 7, '15	06	"

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° '	
43·70 S.-N.E. cor. sec. 17	19	26	6	Aug. 9, '15	25 50	J. A. Calder.
At ¼ W. by. sec. 31	20	26	6	Oct. 8, '15	26 07	"
At Sta. 14 Trav. Hat creek sec. 31	20	26	6	" 11, '15	07	"
39·60 S.-NE. cor. sec. 36	22	26	6	Aug. 21, '15	27 07	"
18·40 S.- " 24	22	26	6	" 23, '15	26 31	"
5·00 S.- " 12	83	26	6	June 8, '15	30 24	L. Brenot.
7·00 S.- " 12	84	26	6	" 4, '15	30 34	"
75·00 E.-NW. " 31	1	27	6	Sept. 22, '15	25 50	P. J. McGarry.
58·00 E.-NE. " 31	1	27	6	" 25, '15	26 06	"
74·00 E.-¼ sec. cor. on E. by., sec. 6	2	27	6	" 29, '15	25 49	"
22·00 N.-NE. cor. sec. 30	1	28	6	Aug. 20, '15	24 46	"
37·00 E.-¼ sec. cor. on E. by. sec. 31	1	28	6	" 23, '15	25 28	"
37·00 E.-¼ sec. cor. on W. by. sec. 30	1	28	6	" 28, '15	06	"
At centre. of sec. 33	1	28	6	Sept. 4, '15	25 15	"
71·00 N.-SE.cor. sec. 4	2	28	6	" 7, '15	24 55	"
At NE. " 3	2	28	6	" 9, '15	25 21	"
10·30 E.-Wit. I.T.S.M. 30 S. for SW. cor. L. 29 G. 1	18	28	6	" 19, '15	27 08	J. A. Calder.
53·00 W.-NE. cor. sec. 21	1	29	6	" 5, '15	24 20	P. J. McGarry.
38·00 N.- " 22	1	29	6	" 7, '15	01	"
At Trav. Sta. 37, sec. 17	3	29	6	Sept. 1, '15	24 41	J. Gibbon.
At " 37 " 17	3	29	6	" 1, '15	42	"
At " 37 " 17	3	29	6	" 1, '15	39	"
2·30 W.-E. ¼ sec. cor. sec. 19	4	29	6	Aug. 13, '15	24 46	"
2·30 W.- " 19	4	29	6	" 13, '15	45	"
2·30 W.- " 19	4	29	6	" 13, '15	47	"
2·30 W.- " 19	4	29	6	" 14, '15	47	"
2·30 W.- " 19	4	29	6	" 14, '15	49	"
2·30 W.- " 19	4	29	6	" 14, '15	47	"
74·20 W.-E. by. sec. 8	4	29	6	" 21, '15	37	"
74·20 W.- " 8	4	29	6	" 21, '15	46	"
74·20 W.- " 8	4	29	6	" 21, '15	47	"
Triangulation pt. 8 E. sec. 10	3	30	6	Oct. 3, '15	22 40	"
" " 10	3	30	6	" 3, '15	41	"
" " 10	3	30	6	" 3, '15	43	"
25·40 N.-NE. cor. sec. 5	4	2	7	Sept. 21, '15	24 46	W. H. Norrish.
At " 6	4	2	7	" 25, '15	24 46	"
25·70 E.-NW. " 7	6	2	7	Aug. 14, '15	22 47	"
50·70 N.-NE. " 7	6	2	7	" 20, '15	24 05	"
25·20 E.-NW. " 17	6	2	7	" 21, '15	27 40	"
9·30 E.-NE. " 17	6	2	7	" 24, '15	22 24	"
43·30 E.- " 17	6	2	7	" 27, '15	23 21	"
28·00 N.- " 16	6	2	7	" 30, '15	28	"
20·20 E.- " 21	6	2	7	Sept. 4, '15	22 32	"
17·30 S.- " 7	6	3	7	July 9, '15	27 21	"
12·10 E.- " 6	6	3	7	" 11, '15	29 15	"
10·10 E.- " 5	6	3	7	" 18, '15	25 12	"
41·40 E.- " 5	6	3	7	" 19, '15	30 50	"
49·30 E.- " 5	6	3	7	" 21, '15	28 22	"
23·40 E.- " 4	6	3	7	" 24, '15	29 39	"
37·10 E.- " 4	6	3	7	" 26, '15	25 28	"
62·00 E.- " 4	6	3	7	" 27, '15	27 19	"
33·10 E.- " 3	6	3	7	" 29, '15	24 17	"
51·90 E.- " 3	6	3	7	" 30, '15	28 04	"
70·80 E.- " 3	6	3	7	" 31, '15	21 19	"
23·40 E.- " 2	6	3	7	Aug. 3, '15	25 18	"
72·90 E.- " 2	6	3	7	" 6, '15	21 38	"
At " 1	6	3	7	" 7, '15	21 14	"
51·30 N.- " 1	6	3	7	" 11, '15	21 03	"
10·66 E.- " 17	6	4	7	May 23, '15	25 14	"
18·70 W.- " 14	6	4	7	June 15, '15	24 59	"
At " 14	6	4	7	" 19, '15	25 24	"
41·10 E.- " 11	6	4	7	" 28, '15	24 20	"
At ¼ sec. cor. N. by. sec. 17	7	....	E C	" 29, '15	24 48	J. Gibbon.
At " 17	7	....	"	" 29, '15	46	"
At " 17	7	....	"	" 29, '15	44	"

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

Table 1.—Declination Observations.—Concluded.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
					° ′	
At ¼ sec. cor. E. by. sec. 24	14		"	Aug. 4, '15	22 35	J. Gibbon.
At " " 24	14		"	" 4, '15	37	"
At " " 24	14		"	" 4, '15	38	"
At " " 24	14		"	" 5, '15	22 32	"
At " " 24	14		"	" 5, '15	41	"
At " " 24	14		"	" 5, '15	35	"
30·60 E.-NW. cor. sec. 6	21		"	Sept. 11, '15	23 55	W. H. Norrish.
23·50 E.-W. ¼ " 23	1		W C	May 22, '15	24 33	J. Gibbon.
23·50 E.-W. ¼ " 23	1		"	June 3, '15	31	"
55·30 W.-NE. " 16	1		"	" 4, '15	42	"
23·60 S.-N. ¼ " 23	1		"	" 10, '15	37	"
23·60 S.-N. ¼ " 23	1		"	" 10, '15	40	"
23·60 S.-N. ¼ " 23	1		"	" 10, '15	34	"
23·60 S.-N. ¼ " 23	1		"	" 14, '15	42	"
23·60 S.-N. ¼ " 23	1		"	" 14, '15	42	"
23·60 S.-N. ¼ " 23	1		"	" 14, '15	37	"
At NE. " 17	2		"	April 27, '15	24 09	"
15·60 E.-W. ¼ " 20	2		"	July 13, '15	13	"
15·60 E.-W. ¼ " 20	2		"	" 13, '15	18	"
15·60 E.-W. ¼ " 20	2		"	" 13, '15	11	"

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Continued.*

TABLE II.—*Inclination and Total Intensity.*

Station. Distance in chains from nearest post.	Township.	Range.	Meridian.	Date.	Inclination.		Total Intensity.		Observer.	Instrument.
					L. M. T.	Value.	L. M. T.	Value.		
								c.g.s.		
0·50 E.-¼ P. N. by. sec. 6	3	12	E. Pr.	May 25	8·8-10·7	77 37·5	9·3- 9·9	0·63289	E. K. Robinson	T.S. 61.
0·50 E.- " 6	3	12	"	" 25	10·0-11·9	37·6	10·8-11·3	0·63256	"	"
39·50 S.-NE. cor. sec. 10	4	10	"	June 6	9·8-11·3	77 35·5	10·3-10·8	0·62730	"	"
39·50 S.- " 10	4	10	"	" 6	10·9-12·4	35·1	11·4-11·9	0·62741	"	"
2·61 N.-¼ N. by. sec. 4	18	20	Pr.	May 13	7·8-10·1	77 59·6	8·7- 9·5	0·63049	"	"
2·61 N.- " 4	18	20	"	" 13	9·6-11·3	78 00·7	10·2-10·8	0·62993	"	"
20·00 S.-NE. cor. sec. 9	3	22	"	Oct. 28	10·3-12·0	77 03·1	10·9-11·4	0·63047	"	"
20·00 S.- " 3	3	22	"	" 28	11·5-15·1	03·0	14·0-14·7	0·62979	"	"
2·50 S.- " 21	15	7	3	Sept. 30	14·6-16·1	76 16·4	15·1-15·6	0·62073	"	"
20·00 S.- " 9	17	7	3	Oct. 3	15·4-17·1	76 31·5	16·1-16·6	0·62364	"	"
20·00 S.- " 9	17	7	3	" 3	16·7-18·0	31·1	17·2-17·6	0·62527	"	"
4·00 S., 9·00 E.-¼ E. by. sec. 13	36	14	3	May 5	10·1-11·2	77 22·0	10·5-10·8	0·62693	R. C. Purser	T.S. 62.
4·00 S., 9·00 E.- " 13	36	14	3	" 5	10·8-12·1	21·2	11·2-11·6	0·62691	"	"
1·00 S., 1·50 W.-NE. cor. sec. 10	36	16	3	June 1	15·4-16·4	77 26·5	15·9-16·2	0·62523	E. J. Wight	"
1·00 S., 1·50 W.- " 10	36	16	3	" 1	16·2-17·1	27·2	16·4-16·8	0·62514	"	"
1·00 S., 1·50 W.- " 10	36	16	3	" 1	16·8-17·8	27·4	17·1-17·5	0·62513	"	"
10·00 N., 10·00 W.- " 15	36	16	3	May 30	8·6- 9·8	77 25·0	9·2- 9·5	0·62490	"	"
10·00 N., 10·00 W.- " 15	36	16	3	" 30	9·5-10·6	25·1	9·8-10·2	0·62399	"	"
10·00 N., 10·00 W.- " 15	36	16	3	" 30	10·2-11·3	25·0	10·6-10·9	0·62390	"	"
5·00 S., 22·00 W.- " 16	36	16	3	" 31	8·8-10·0	77 27·6	9·3- 9·7	0·62356	"	"
5·00 S., 22·00 W.- " 16	36	16	3	" 31	9·7-10·7	27·7	10·0-10·4	0·62346	"	"
5·00 S., 22·00 W.- " 16	36	16	3	" 31	10·4-11·4	27·4	10·7-11·0	0·62344	"	"
20·00 W.-¼ E. by. sec. 21	38	16	3	" 24	8·5-10·1	77 28·3	9·0- 9·6	0·62216	R. C. Purser	"
20·00 W.- " 21	38	16	3	" 24	9·7-10·9	28·4	10·1-10·5	0·62161	"	"
18·00 N.-NE. cor. sec. 23	18	17	3	Sept. 11	14·3-15·9	76 16·1	14·8-15·3	0·61917	E. K. Robinson	T.S. 61.
18·00 N.- " 23	18	17	3	" 11	15·5-17·0	15·7	16·0-16·6	0·61711	"	"
1·00 S.- " 36	18	19	3	" 16	9·5-10·9	76 12·5	10·1-10·5	0·62164	"	"
39·00 S.- " 3	13	22	3	Aug. 17	14·2-15·7	75 47·5	14·7-15·2	0·62544	"	"
39·00 S.- " 3	13	22	3	" 17	15·3-16·7	47·1	15·8-16·3	0·62497	"	"
5·00 W.- " 36	12	29	3	" 7	15·0-16·4	75 24·2	15·4-16·0	0·61550	"	"
5·00 W.- " 36	12	29	3	" 7	16·0-17·5	24·6	16·4-16·9	0·61516	"	"
25·00 N., 30·00 W.-NE. cor. sec. 3	53	1	4	June 26	7·4- 8·5	78 02·2	7·8- 8·2	0·62167	E. J. Wight	T.S. 62.
25·00 N., 30·00 W.- " 3	53	1	4	" 26	8·2- 9·3	02·6	8·5- 8·9	0·62171	"	"
25·00 N., 30·00 W.- " 3	53	1	4	" 26	8·9- 9·9	02·6	9·2- 9·6	0·62171	"	"

RESULTS OF MAGNETIC OBSERVATIONS, 1915-16.—*Concluded.*

TABLE II.—*Inclination and Total Intensity*—Concluded.

Station. Distance in chains from nearest post.	Township.	Range.	Meridian.	Date.	Inclination.		Total Intensity.		Observer.	Instrument.
					L. M. T.	Value.	L. M. T.	Value.		
								c.g.s.		
4·30 W., 4·30 N.-N.E. cor. sec. 24	53	1	4	June 16	8·5 9·9	78 08·2	9·0- 9·5	0·62330	R. C. Purser	T.S. 62
4·30 W., 4·30 N.- " 24	53	1	4	" 16	9·5 10·9	06·5	9·9 10·4	0·62177	"	"
4·30 W., 4·30 N.- " 24	53	1	4	" 16	10·4 11·6	07·8	10·9 11·3	0·62207	"	"
6·00 S., 25·00 W.-¼ E. by. sec. 12	43	3	4	July 5	8·0- 9·4	77 31·8	8·4- 8·9	0·62677	"	"
6·00 S., 25·00 W.- " 12	43	3	4	" 5	8·9-10·2	32·1	9·4 9·8	0·62735	"	"
6·00 S., 25·00 W.- " 12	43	3	4	" 5	9·8-11·1	32·7	10·2-10·7	0·62697	"	"
13·00 E., 16·00 S.-NE. cor. sec. 32	28	5	4	" 21	7·1- 8·3	76 17·2	7·5 7·9	0·61676	E. J. Wight	"
13·00 E., 16·00 S.- " 32	28	5	4	" 21	7·9- 8·9	76 17·2	8·3 8·6	0·61676	"	"
13·00 E., 16·00 E.- " 32	28	5	4	" 21	8·6 9·6	17·2	8·9 9·3	0·61679	"	"
20·00 N., 3·00 E.- " 8	41	12	4	" 8	7·9- 9·4	76 52·6	8·3- 8·9	0·61831	R. C. Purser	"
20·00 N., 3·00 E.- " 8	41	12	4	" 8	8·9 10·0	53·3	9·4 9·7	0·61833	"	"
20·00 N., 3·00 E.- " 8	41	12	4	" 8	9·7 10·6	52·0	10·1-10·3	0·61819	"	"
1·00 W.-centre sec 5	31	14	4	" 23	9·5-10·8	76 23·0	10·0 10·5	0·61706	E. J. Wight	"
1·00 W.- " 5	31	14	4	" 23	10·4-11·5	23·2	10·8 11·1	0·61707	"	"
1·00 W.- " 5	31	14	4	" 23	11·1-12·2	23·0	11·4 11·9	0·61706	"	"
16·50 N.-SE. cor. sec. 2	1	26	4	" 26	9·1 10·4	74 13·6	9·4- 9·9	0·61241	E. K. Robinson	T.S. 61
16·50 N.- " 2	1	26	4	" 26	10·0 11·4	15·2	10·3 10·9	0·61210	"	"
12·00 E., 26·00 S.-NE. cor. sec. 4	53	27	4	Aug. 4	13·6 14·6	77 08·9	14·0 14·3	0·61783	E. J. Wight	T.S. 62
12·00 E., 26·00 S.- " 4	53	27	4	" 4	14·3-15·4	08·7	14·6 15·0	0·61783	"	"
12·00 E., 26·00 S.- " 4	53	27	4	" 4	15·0 16·1	08·9	15·4 15·7	0·61786	"	"
4·15 S., 3·00 W.-¼ E. by. sec. 11	53	4	5	July 31	13·0 14·1	77 17·2	13·4-13·9	0·61720	"	"
4·15 S., 3·00 W.- " 11	53	4	5	" 31	13·9-14·8	17·3	14·1 14·4	0·61723	"	"
4·15 S., 3·00 W.- " 11	53	4	5	" 31	14·4-15·4	17·2	14·7-15·1	0·61723	"	"
0·25 S.-NE. cor. sec. 26	25	12	5	June 12	15·1-16·8	74 54·1	15·8 16·2	0·61294	E. K. Robinson	T.S. 61
0·25 S.- " 26	25	12	5	July 19	15·6-16·1	55·8	16·0-16·5	0·61164	"	"

APPENDIX No. 73.

SURVEYS LABORATORY—RESULTS OF WATCH TESTS.

SURVEYS LABORATORY METHOD.

Name.	Number of Watch.	Escapement, Balance Spring, etc	Mean Daily Variation of Mean Daily Rate.								Mean Error.	Diff. between m.d.r. and m. of m.d.r. at 65° F.						Mean Error.	M. ch. of r. for	Total Marks.
			P.U. 65°	P.R. 65°	P.L. 65°	D.U. 40°	D.U. 65°	D.U. 90°	D.D. 65°	P.U. 65°	α	P.U.	P.R.	P.L.	D.U	D.D.	P.U.		β	1° F.
Maximum values allowable.			2·0	2·0	2·0	2·0	2·0	2·0	2·0	2·0	0·75	7·5	7·5	7·5	7·5	7·5	7·5	3·5	0·3	
Waltham Watch Co	16167498	D.r., g.b., l.c., s.o.	0·23	0·54	0·28	0·51	0·29	0·17	0·73	0·42	0·40	+1·61	−1·17	+0·45	+0·01	+0·19	−1·07	0·75	0·01	694·3
"	19001082	"	0·42	0·52	0·18	0·39	0·37	0·25	0·21	0·35	0·34	−0·42	−2·94	+2·94	+2·22	−1·28	−0·50	1·72	0·03	602·1
Hamilton Watch Co.	688341	"	0·82	0·58	0·23	0·94	0·35	0·23	0·18	1·01	0·54	−1·28	−0·08	−0·52	+0·88	+2·62	−1·62	1·17	0·05	547·0
Waltham Watch Co.	18028564	"	0·48	0·35	0·66	0·46	0·22	0·38	0·30	0·46	0·41	+1·53	+1·47	−3·31	+1·79	+0·11	−1·59	1·63	0·08	544·3
Hamilton Watch Co.	688370	"	0·46	0·38	0·23	0·74	0·43	0·58	0·43	0·38	0·45	+1·74	−2·20	−2·20	−0·58	+2·82	+0·40	1·66	0·05	538·3
"	374	"	0·58	0·28	0·14	0·67	0·20	0·22	0·48	0·21	0·35	+4·50	−4·28	+1·04	−0·78	−1·68	+1·18	2·24	0·06	519·3
"	366	"	0·20	0·54	0·59	0·41	0·34	0·17	0·34	1·31	0·49	+2·88	−1·20	−0·26	−1·70	−1·36	+1·62	1·50	0·09	506·0
"	360	"	0·18	0·10	0·29	0·67	0·22	0·13	0·42	1·16	0·39	+2·44	−5·30	+0·66	−0·40	−0·52	+3·14	2·08	0·13	470·3
Waltham Watch Co	19001097	"	0·17	0·42	0·16	0·11	0·16	0·38	0·22	0·21	0·23	+3·10	−5·70	−3·32	+1·88	+0·70	+3·32	3·00	0·12	453·3
"	72	"	0·39	0·54	0·43	0·67	0·31	0·46	0·38	0·62	0·48	−0·30	−2·72	+3·42	+0·50	+1·64	−2·52	1·85	0·13	443·3
"	18028592	"	0·92	0·66	0·78	0·41	0·28	0·32	0·46	0·42	0·53	+0·88	+1·16	+0·30	+2·68	−3·00	−2·04	1·68	0·11	439·9
Hamilton Watch Co.	688377	"	0·78	0·18	0·31	1·58	0·67	0·35	0·41	0·94	0·65	+3·01	−4·19	+0·29	+0·17	−0·23	+0·95	1·47	0·07	436·0
"	584	"	0·43	0·39	0·36	0·49	0·44	0·43	0·36	0·80	0·46	+3·24	−2·44	−4·10	+2·70	−0·80	+1·40	2·45	0·08	422·7
Waltham Watch Co	18028511	"	0·76	0·64	1·10	1·01	1·02	0·30	0·55	0·52	0·74	+2·34	−0·66	−1·94	+0·02	+1·38	−1·16	1·25	0·12	382·4
"	18091020	"	0·63	0·29	0·60	0·26	0·61	0·33	0·46	1·06	0·53	+6·81	−2·29	−1·45	+0·31	−2·87	−0·53	2·38	0·11	372·0
"	18028537	"	0·41	0·51	0·28	0·66	0·17	0·22	0·61	1·79	0·58	+4·46	−0·72	−1·68	+2·58	−0·22	−4·44	2·35	0·09	364·1
Hamilton Watch Co.	688367	"	0·34	0·38	0·50	0·98	1·20	0·15	0·55	0·58	0·58	+5·14	−4·40	0·00	−3·38	+1·06	+1·60	2·69	0·07	345·6
Waltham Watch Co.	18028581	"	0·37	0·15	1·46	0·29	0·47	0·18	0·30	0·52	0·47	+0·97	−4·25	+4·03	+0·03	+1·43	+2·19	2·15	0·28	320·3
Hamilton Watch Co.	688342	"	0·49	0·18	0·27	0·59	0·32	0·21	0·70	1·42	0·52	+7·05	−2·53	−3·27	−1·91	−2·79	+3·43	3·50	0·07	278·7
Waltham Watch Co.	18028509	"	0·34	0·31	0·68	0·46	0·30	1·39	0·14	1·08	0·59	+3·96	+3·18	−4·46	+1·40	−2·44	−1·66	2·85	0·12	276·9
"	16167507	"	0·80	0·26	1·43	0·35	0·22	0·29	0·37	0·67	0·55	−0·40	+4·48	−6·42	+2·42	+3·04	−3·14	3·32	0·12	245·3
		Means.	0·49	0·39	0·52	0·60	0·41	0·34	0·41	0·76	0·49	2·76	2·73	2·19	1·35	1·53		2·08	0·09	

Name.	Number of Watch.	Escapement, Balance Spring, etc.	Mean deviation of daily rate.	Mean of daily rate for each pair of position tests.	Deviation for change of position.	Maximum difference between mean rates of position tests.	Difference between mean rates of P.U. and D.U. positions.	Difference between mean rates of D.U. and D.D. positions.	Progressive change of rate for position tests.	Recovery of rate.	Change of r. per 1° C.		Algebraic difference between A and B.	Isochronism Error.	Marks.
											A 4:4–18:3	B 4:4–32:2			
Maximum values allowable.			0ˢ·75		3ˢ·0	10ˢ·0	5ˢ·0	4ˢ·0	3ˢ·0	6ˢ·0		0ˢ·20	0ˢ·3	3ˢ·0	
	T.S. 491	D.r., g.b., l.e., s.o.	0·30	+0·47	1·19	3·80	2·56	1·58	−0·72	−2·37	−0·036	+0·049	0·08	+1·7	64·1 p.c.
Waltham Watch Co.	14172573	"	0·33	−5·87	1·44	5·13	3·26	1·87	+0·36	+1·27	−0·236	−0·111	0·12	−0·1	56·3
"	18028587	"	0·43	+0·09	0·76	2·23	2·23	0·53	+0·05	+2·10	+0·055	+0·105	0·16	+2·7	55·9
"	18091025	"	0·35	+3·22	0·59	2·19	1·07	0·09	+0·73	+1·73	+0·013	+0·194	0·18	+0·5	54·7
"	14125109	"	0·30	+2·81	2·09	7·47	0·23	2·22	+0·30	+0·27	+0·122	+0·065	0·19	+1·2	51·6
"	19001011	"	0·42	−1·83	1·59	4·78	1·42	3·36	+0·08	+0·27	−0·314	−0·049	0·26	+0·3	48·0
"	18028543	"	0·31	−0·27	2·94	9·63	1·20	2·22	+0·95	+1·53	−0·206	−0·057	0·15	+1·3	43·3
		Means.....	0·35	2·08	1·51	5·03	1·71	1·70	0·46	1·36	0·14	0·09	0·16	1·1	

APPENDIX No. 74.

Surveying Instruments on Hand, March 31, 1916.

Instruments.	In Store April 1915.	Purchased	Sold.	Balance on Hand.		Remarks.
				Loan.	Store.	
Abney levels	42	27	28	3	38	
Alidades	1				1	
Alt-azimuths	1				1	
Aneroids	94		3	10	81	
Artificial Horizons	4				4	
Base line apparatus	1				1	
Cameras and Kodaks	18			1	17	
Chronometers and Sidereal Watches	62	1	7	7	48	1 returned to factory.
Compasses	34				34	
Current Meters and logs	4				4	
Dip circles	2				2	
Field glasses and binoculars	7	1		1	5	1 lost. 1 stolen.
Levels	38	15		30	23	
Levelling rods	65	22		42	38	7 worn out.
Micrometer telescopes	8				8	
Optical squares	1				1	
Pedometers	2				2	
Photo-theodolites	5			1	4	
Plane tables	1				1	
Protractors	40	40		44	34	2 broken.
Rod levels	22			6	13	3 worn out.
Sextants and reflecting circles	3				3	
Solar compasses	2				2	
Stadia rods	19	76	47	1	47	
Stadia slide rules	21	40		27	34	
Steel tapes	139	56	55	13	126	1 worn out.
Subsidiary standard measures	102		12		90	
Survey pickets	2				2	
Surveying cameras	4			1	3	
Tally registers	12				12	
Tape stretching apparatus	1				1	
Telemeters	1			1		
Thermometers	16		2	6	8	
Transit Theodolites	64	22	21	11	53	1 struck off.
Zenith Telescopes	1				1	

DEPARTMENT OF THE INTERIOR, CANADA
IRRIGATION BRANCH

ROLL OF HONOUR

Employees Enlisted for Active Service

J. W. H. Wilkes	Leveller	Aug. 16, 1914	Lieut. 3rd Brig. R.H.A.
E. S. McMillan	Draughtsman	Aug. 21, 1914	L. Corp. Div'l Engineers
W. E. Dow	Draughtsman	Aug. 22, 1914	Bombing Instr. 13th M.D.
C. V. Craik	Engineer	Aug. 22, 1914	Corp. Div'l Engineers
E. S. Clifford	Hydro. Asst.	Aug. 24, 1914	Maj., Asst. Provost Marshal
R. V. Muller	Leveller	Aug. 26, 1914	Tpr. Royal Can. Dragoons
C. E. Vrooman	Leveller	Sept. 26, 1914	Spr. Div'l Engineers
C. P. Maxted*	Rodman	Sept. 26, 1914	Spr. Div'l Engineers
H. E. Bowden	Teamster	Sept. 26, 1914	Spr. Div'l Engineers
J. S. Ferrier	Draughtsman	Nov. 6, 1914	Lieut. Machine Gun Corps
H. D. St.A. Smith	Engineer	Nov. 9, 1914	Major Div'l Engineers
C. B. Hornby†	Accountant	Nov. 16, 1914	Capt. & Adj. 31st Battalion
G. N. Page	Leveller	Nov. 16, 1914	Pte. Army Service Corps
D. C. McDougall	Accountant	Nov. 19, 1914	Q.M.S. Div'l Engineers
G. H. Nettleton	Hydro. Asst.	Jan. 4, 1915	Lieut., Prov. Marshal's Staff
N. J. Arnold	Draughtsman	Jan. 28, 1915	Staff Sergt. 175th Batt.
H. S. Kerby	Engineer	Feb. 11, 1915	Lieut. R.N. Flying Corps
J. H. Jones	Engineer	Apr. 26, 1915	Capt. Div'l Engineers
E. W. W. Hughes	Engineer	May 8, 1915	Pte. 53rd Battalion
G. R. Elliott	Engineer	Aug. 16, 1915	Lieut. Signallers Can. Eng'rs
W. T. White†	Engineer	Aug. 16, 1915	Capt. 1st Pioneer Battalion
N. R. English‡	Rodman	Sept. 15, 1915	Pte. 4th Univ.Co.P.P.C.L.I.
H. W. Cheney	Engineer	Sept. 29, 1915	Lieut. 4th University Co.
W. E. Hunter	Accountant	Oct. 2, 1915	Sergt.-Major 87th Battalion
E. L. Hornby	Draughtsman	Oct. 12, 1915	Pte. 16th Batt. Can. Scottish
J. Cawthorn	Clerk	Oct. 14, 1915	Co. Q.M.S. 1st Pioneer Batt.
H.B. R. Thompson	Engineer	Nov. 8, 1915	Pte. 1st Pioneer Battalion
F. R. Burfield	Engineer	Dec. 31, 1915	2nd Lieut. Royal Engineers
W. G. Guthrie	Draughtsman	Feb. 20, 1916	Pte. Army Medical Corps
L. E. M. Shenton	Draughtsman	Feb. 24, 1916	Sergt. Australian Imp.Forces
W. B. Hutcheson	Engineer	Mar. 13, 1916	Lieut. Royal‡Flying Corps
H. R. Carscallen	Engineer	Mar. 31, 1916	Lieut. Div'l Engineers
W. R. McCaffrey	Engineer	Mar. 31, 1916	Sergt. Can. Reserve Cyclists
R. E. Matheson	Hydro. Asst.	Mar. 31, 1916	Spr. Div'l Engineers
P. J. Jennings	Office Engnr.	Apr. 1, 1916	Capt.& Adj.4th Pioneer Batt.
G. H. Whyte†	Engineer	Apr. 4, 1916	Lieut. Div'l Engineers
T. H. Burt	Hydro. Asst.	Apr. 4, 1916	Pte. Army Medical Corps
R. H. Goodchild	Engineer	Apr. 22, 1916	Lieut. 4th Pioneer Battalion
L. J. Gleeson	Engineer	May 9, 1916	Corp. 50th Queen's Battery
F. K. Beach	Engineer	May 21, 1916	Lieut. 8th Can. Ry. Con.Batt.
J. M. Paul‰	Engineer	May 22, 1916	Gunr. 72nd Queen's Battery
O. H. Hoover	Engineer	June 15, 1916	Gunr. 67th O.S. Battery
I. R. Strome	Engineer	June 20, 1916	Lieut. 25th Reserve Battalion
J. A. Currie	Draughtsman	Aug. 1, 1916	Gunr. 73rd Field Battery
G. C. McIntosh	Draughtsman	Aug. 19, 1916	Pte. Div'l Cyclists

*DIED OF WOUNDS
†AWARDED MILITARY CROSS
‡KILLED IN ACTION
‰DIED OF SICKNESS

A. C. Wimberley	Draughtsman	Sept. 1, 1916	Gunr. 72nd Battery
R. J. Srigley	Hydro. Asst.	Oct. 1, 1916	Pte. 187th Battalion
R. J. McGuinness	Engineer	Nov. 15, 1916	Pte. 239th Battalion
A. E. Hughes	Packer	Nov. , 1916	Pte. 211th Battalion
R. J. G. White	Chief Clerk	Dec. 1, 1916	Spr. Div'l Engineers
V. Meek	Engineer	Dec. 11, 1916	Lieut. Tunnelling Co.
T. M. Montague	Engineer	Dec. 11, 1916	Lieut. Tunnelling Co.
J. A. Telfer	Leveller	Jan. 1, 1917	Pte. Div'l Engineers
J. E. Caughey	Engineer	Mar. 1, 1917	Lieut. 78th Battery, C.F.A.
E. J. Switzer	Engineer	Mar. 12, 1917	Gunr. 38th Siege Battery
R. H. Waterhouse	Clerk	May 12, 1917	Pte. Can. Army Med. Corps

REPORT

OF

HYDROMETRIC SURVEYS

(STREAM MEASUREMENTS)

FOR

THE CALENDAR YEAR 1916

PREPARED UNDER THE DIRECTION OF

F. H. PETERS, D.L.S., M. Can. Soc. C.E.,

COMMISSIONER OF IRRIGATION

BY

P. M. SAUDER, D.L.S., M. Can. Soc. C.E., Chief Hydrometric Engineer

ASSISTED BY

V. A. NEWHALL, B.A. Sc., and W. H. STOREY,

DIVISIONAL HYDROMETRIC ENGINEERS

PRINTED BY ORDER OF PARLIAMENT

OTTAWA

J. DE LABROQUERIE TACHÉ, PRINTER TO THE KING'S MOST EXCELLENT MAJESTY

1917

[No. 25b—1917—29191c]

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Corrected table for table on page 267, of 1915 Report, between pages ... 322 and 323
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To His Excellency, The Duke of Devonshire, K.G., G.C.M.G., etc., etc., Governor-General of the Dominion of Canada.

May it Please Your Excellency:

The undersigned has the honour to lay before Your Excellency the report of Hydrometric Surveys, for the year 1916.

Respectfully submitted,

W. J. ROCHE,
Minister of the Interior

Ottawa, May 18, 1917.

REPORT

OF

HYDROMETRIC SURVEYS FOR THE CALENDAR YEAR 1916

By P. M. SAUDER, V. A. NEWHALL and W. H. STOREY

INTRODUCTION

SCOPE OF WORK

The chief features of the stream measurement work are the collection of data relating to the flow of surface waters and a study of the conditions affecting this flow. Information is also collected concerning river profiles, the duration and magnitude of floods, irrigation and water-power development, storage, seepage, etc., which may be of use in hydrometric studies.

This information is obtained by a series of observations at regular gauging stations which are established at suitable points. The selection of sites for these gauging stations and their maintenance depend largely upon the physical features and needs of the locality. If water is to be used for irrigation purposes the summer flow receives special attention; where it is required for power purposes, it becomes necessary to determine the minimum flow; if water is to be stored, information is obtained regarding the maximum flow. In all cases the duration of the different stages of the stream is recorded. Throughout the country gauging stations are maintained for general statistical purposes, to show the conditions existing through long periods. They are also used as primary stations, and their records in connection with short series of measurements will serve as bases for estimating the flow at other points in the drainage basin.

During the open water season of 1916, records were taken at one hundred and seventy-seven (177) regular gauging stations on various streams in Alberta and Saskatchewan and at one hundred and thirty-eight (138) regular gauging stations on irrigation ditches and canals. Winter records which are so valuable for power investigations and municipal water supplies, received special attention and records were secured on almost all the important streams in the two provinces, throughout the year.

ORGANIZATION

The methods of carrying on the investigations were similar to those of previous years. Local residents were engaged to observe the gauge heights at regular stations. These observations were recorded in a book supplied by the department, and at the end of each week the observer copied the week's records on a postal card which he forwarded to the Calgary office by the first convenient mail.

District hydrometric engineers made regular visits to the gauging stations, usually once in every three weeks. On these visits they examined the observer's records, made discharge measurements and collected such information and data as would be of use in making estimates of the daily flow at the station. The results of the discharge measurements and all data collected were forwarded as soon as possible after being completed, to the Calgary office, where all reports are copied on regular forms and filed.

During the winter no records were taken at a number of the gauging stations, which made it possible to reduce the field staff and have each engineer spend some time in the office and assist in the final computations and estimates of run-off. As far as possible the same engineer that did the field work made or checked the office computations, so as to eliminate any chance of error through lack of knowledge of the conditions at the gauging station.

Gauge height—area, gauge height—mean velocity and gauge height—discharge curves were plotted and rating tables constructed. Tables of discharge measurements, daily gauge height and discharge, and monthly discharge were also compiled. These records have been collected and are embodied in this, the Eighth Annual Report of the Hydrometric Survey.

At the beginning of 1916 the organization of the staff under the chief hydrometric engineer was changed, and the whole territory and work was divided into two divisions, namely, Northern and Southern. An engineer, designated the Divisional Hydrometric Engineer, was placed in charge of each division and was given a staff consisting of one field engineer for each district in his division, an office engineer and a recorder. This increased the office staff and made it possible for the divisional engineers to spend considerable time in the field and exercise better supervision over the work. This is particularly necessary at the present time, when as a result of enlistments, there are so many new and very often inexperienced engineers employed.

During 1916, the Southern Division included the Macleod, Cardston, West Cypress Hills, East Cypress Hills, Maple Creek and Saskatoon districts, while the Northern Division included the Banff, Calgary, Nordegg, Edmonton, Jasper and Peace River districts.

In each district there was one engineer who, while in the field, employed temporary assistance and was equipped with the necessary gauging and surveying instruments. In Macleod, Saskatoon, Banff, Calgary, Edmonton, Jasper and Peace River districts, the engineers travelled by train and hired livery, while in the Cardston, West Cypress Hills, East Cypress Hills and Maple Creek districts they were supplied with horses and democrats. The engineer in the Nordegg district was supplied with a pack train.

During the early spring extra assistance was requisitioned from the Irrigation Administration staff to assist in collecting records of the early spring run-off in the Cypress hills. Extra assistance was also obtained in the same manner during the high-water period in Southern Alberta, in June.

BANFF DISTRICT

This district included the following regular gauging stations:

Stream	Location	Date Established
Bath creek	NE. 32-28-16-5	April 9, 1913
Bow river	SE. 28-28-16-5*a*	July 18, 1910
Bow river	SE. 35-25-12-5	May 25, 1909
Bow river	NW. 32-24-8-5	March 10, 1912
Bow river	SE. 2-21-19-4*b*	August 20, 1909
Cascade river	SE. 19-26-11-5	August 16, 1911
East Br. Canadian Pacific Railway Canal	SE. 3-21-18-4	June 6, 1914
North Br. Canadian Pacific Railway Canal	NW. 3-21-18-4	June 6, 1914
Elbow river	NW. 12-23-5-5	Sept. 29, 1914
Fortymile creek	SW. 2-26-12-5	July 31, 1912
Ghost river	NE. 23-26-6-5	August 17, 1911
Jumpingpound creek	SE. 30-24-4-5	May 7, 1908
Kananaskis river	SW. 34-24-8-5*c*	August 31, 1911
Louise creek	NE. 20-28-16-5	July 5, 1913
Pipestone river	SW. 27-28-16-5	August 31, 1911
Red Deer river	NW. 11-29-20-4	October 25, 1915
Spray creek	SW. 32-22-10-5	July 24, 1914
Spray river	SE. 31-22-10-5	July 23, 1914
Spray river	SW. 25-25-12-5	July 15, 1910

Records have been obtained throughout the year on all the above stations excepting those on Spray river (SE. 32-22-10-5) and Spray creek, where observers were not available during the winter months, and on Jumpingpound creek, where only open water records were desired.

Miscellaneous gaugings were made of Beaupre creek (SE. 15-26-5-5), Big Hill creek (SW. 10-26-4-5), Grand Valley creek (SW. 24-26-5-5), Horse creek (NE. 8-26-4-5), Spencer creek (SE. 18-26-5-5), and the tail-race of Lake Louise power house.

Floods of unusual size occurred on all streams west of Seebe during June, in 1916, but no very great damage was done. During the danger period flood prediction stations were maintained on Bow river at Banff and Cochrane. The observers at these stations telephoned or telegraphed the gauge heights to the office once or twice a day, and when these reports showed the danger of flood on the lower reaches of the river, a warning was sent out to public officials in the locality threatened by floods.

H. C. Ritchie, A.M. Can. Soc. C.E., was in charge of this district during 1916. He was relieved in the field for a short period by W. K. Broughton, and was assisted with the final computations by A. B. Cook.

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a This station was originally located on NE. 28-28-16-5, but was moved to its present position on August 31, 1911.
b This station was originally located on Sec. 13-21-19-4, but was moved to its present position in May, 1913.
c This station was originally located on NW. 32-24-8-5, but was moved to its present position on May 13, 1913.

CALGARY DISTRICT

This district included the following regular gauging stations:

Stream	Location	Date Established
Bow river	NE. 15-24-1-5*a*	Nov. 25, 1910
Canadian Pacific Railway Company Canal	NE. 21-23-29-4*b*	May 18, 1911
Elbow river	SW. 14-24-1-5	May 8, 1908
Nose creek	SW. 35-24-1-5*c*	April 24, 1911

Winter records were obtained on the Bow and Elbow rivers, and these stations with certain other stations in the vicinity of Red Deer and Rocky Mountain House made up the Calgary winter district.

This district also included the current-meter rating station. The rating tank was filled about April 3, and drained for the winter about November 8.

During the season 69 current-meters, made up as follows, were rated:

Irrigation Branch	45
British Columbia Hydrometric Survey	10
Manitoba Hydrometric Survey	9
Department of Natural Resources, Canadian Pacific Railway Company	3
Shawinigan Water & Power Company, Montreal, P.Q.	2
TOTAL	69

O. H. Hoover, B.A.Sc., and S. H. Frame were in charge of the field work during the winter of 1916, and W. K. Broughton during the summer. Mr. Broughton also made the computations for the current-meter ratings, but the final computations for the gauging stations were made by A. B. Cook and C. S. Dewis.

MACLEOD DISTRICT

This district included the following regular gauging stations:

Stream	Location	Date Established
Allison creek	SW. 11-8-5-5	July 23, 1913
Canyon creek	NE. 14-6-2-5	July 6, 1910
Carbondale river	SE. 15-6-3-5	April 19, 1916
Castle river	SW. 30-6-2-5	Apri 18, 1916
Castle river	SW. 2-7-1-5	August 5, 1909
Connelly creek	SE. 36-7-2-5	July 31, 1909
Cow creek	NE. 14-8-2-5	May 26, 1910
Crowsnest river	SW. 12-8-5-5	July 28, 1910
Crowsnest river	NE 36-7-4-5	July 28, 1910
Crowsnest river	NE. 26-7-2-5	Sept. 7, 1907
Elton ditch	NE. 19-8-1-5	July 10, 1912
Findlay & McDougall ditch	SW. 31-18-29-4	June 17, 1911
Fish creek	SW. 26-22-3-5	May 13, 1907
Highwood river	SE. 20-18-2-5	July 27, 1912
Highwood river	NW 17-20-28-4	October 3, 1911
Huff ditch	NW. 30-8-1-5	July 11, 1912
Little Bow ditch	SW. 6-19-28-4	August 1, 1910
McGillivray creek	SE. 7-8-4-5	July 23, 1913
Mill creek	SW. 18-6-1-5	July 7, 1910
Mosquito creek	NE. 30-16-28-4	August 1, 1908
Muddypound creek	SW. 27-11-28-4	July 27, 1908
Nanton creek	SE. 19-16-28-4*d*	August 3, 1908
Oldman river	NE. 34-7-1-5	Sept. 15, 1908
Oldman river	NW. 10-9-26-4	July 12, 1910
Oldman river	NW. 1-9-22-4	August 31, 1911
Pekisko creek	NW. 8-17-2-5	October 6, 1911
Pincher creek	SW. 23-6-30-4	August 13, 1906
N. B. Sheep river	SW. 12-21-3-5	May 22, 1908

a A station was maintained on SE. 12-24-1-5, from May 5, 1908, to October 21, 1910.
b During 1908, 1909 and 1910 records were taken at a station on road allowance east of Sec. 36-23-1-5.
c This station was originally located on NW. 13-24-1-5, but was moved to its present position on May 3, 1916.
d This station was originally located on the NW. 20-16-28-4, but was moved to its present position on May 1, 1913.

Stream	Location	Date Estalished
S. B. Sheep river	SW. 17-20-2-5	May 23, 1908
Sheep river	NW. 22-20-29-4	May 25, 1908
Stimson creek	NW. 2-17-2-5*a*	October 6, 1911
St. Mary river	NE. 26-7-22-4	October 13, 1911
Todd creek	SW. 19-8-1-5	August 3, 1909
Trout creek	SE. 32-11-28-4	July 7, 1911
Willow creek	NE. 20-9-26-4	August 13, 1915

Miscellaneous gaugings were made of Bellevue creek (NE. 29-7-3-5), Blairmore creek (SE. 10-8-4-5), Drumm creek (NW. 18-7-3-5), Gold creek (NE. 30-7-3-5), Lyons creek (SE. 35-7-4-5), Nez Percé creek (NW. 17-8-4-5) and York creek (NW. 34-7-4-5).

Winter records were obtained on Castle river (lower station), Crowsnest river (three stations), Oldman river (three stations), St. Mary river, Highwood river (two stations), Sheep river, and most of the creeks shown in the miscellaneous list. The Oldman river (NW. 1-9-22-4) and St. Mary river were added to the Cardston district, while the South Saskatchewan river (NW. 31-12-5-4) was added to the Macleod district during the winter months. All other stations were discontinued during the winter.

Stevens Continuous Water Stage Records were used during open water in 1916 on the Oldman river near Macleod and the St. Mary river near Lethbridge.

The field work in this district was in charge of W. R. McCaffrey, B.A.Sc., H. W. Rowley, B.Sc., J. M. Paul, B.E., and W. M. Edwards, B.A.Sc., for various periods, and V. A. Newhall, B.A.Sc., J. R. Estey, B.Sc., A. L. Tregillus and W. S. J. Miller made the final computations for this report.

CARDSTON DISTRICT

This district included the following regular gauging stations:

Stream	Location	Date Established
Alberta Railway and Irrigation Company canal	SE. 36-1-25-4	April 27, 1915
Alberta Railway and Irrigation Company canal	SE. 21-2-24-4	July 26, 1910
Alberta Railway and Irrigation Company canal	NW. 28-4-23-4	May 1, 1914
Belly River	NE. 5-2-28-4	Nov. 1, 1911
Belly river	SE. 21-6-25-4	May 27, 1909
Boundary creek	NW. 20-1-26-4	June 18, 1913
Cameron creek	SW. 23-1-30-4	Jan. 2, 1916
Christianson ditch	SE. 12-3-28-4	Sept. 14, 1911
Crooked creek	SW. 22-2-29-4*b*	Sept. 15, 1909
Etzikom coulee	SW. 3-7-19-4	April 16, 1914
Etzikom coulee	SW. 2-5-13-4	May 28, 1915
Fidler ditch	SE. 19-1-26-4	Sept. 13, 1911
Lee creek	SE. 27-2-26-4*c*	May 5, 1913
Mami creek	SE. 19-2-27-4	August 13, 1909
N.B. Milk river	NE. 11-1-23-4*d*	July 21, 1909
S.B. Milk river	SW. 29-37N-9W.P.M. Montana, U.S.A.	By U.S.G.S. in 1905
Milk river	NE. 21-2-16-4	May 18, 1909
Pinepound creek	NE. 29-4-23-4	April 30, 1914
Pothole creek	NE. 1-6-22-4	April 28, 1914
Pothole creek	NW. 10-5-22-4	April 27, 1914
Rolph creek	SE. 21-2-24-4	May 17, 1911
St. Mary river	NW. 25-1-25-4	By A.R. and I. Co. in 1905
Waterton river	NE. 8-2-29-4	August 26, 1908
Waterton river	NW. 28-6-25-4	Nov. 5, 1915

Miscellaneous gaugings were made of Blakiston brook (SE. 36-1-30-4) and Crooked creek (SW. 16-2-29-4).

Winter observations were made on Belly river (two stations), Blakiston brook, Cameron creek, Lee creek, Milk river, North and South Branches of Milk river, St. Mary river and Waterton river (two stations). In addition the winter district included Oldman river (NW. 1-9-22-4) and St. Mary river (NE. 26-7-22-4).

---

a This station was moved on July 4, 1912, to the NW. 2-17-2-5, but was moved to its present position on April 4, 1916.

b This station was originally located on the SE. 22-2-29-4, but was moved to the SW. 23-2-29-4 on June 15, 1911, and to its present position on October 15, 1912.

c A station was maintained on the NW. 10-3-25-4 from June 28, 1909, to July 13, 1914.

d This station was originally located on the NE. 13-1-23-4, but was moved to its present position on May 1, 1913.

The stations on St. Mary (NW. 25-1-25-4) and North and South Branches of Milk river are equipped with automatic gauges and are maintained jointly by this branch with the Water Resources Branch of the United States Geological Survey.

V. A. Newhall, B.A.Sc., S. H. Frame, A.M. Can. Soc. C.E., and H. W. Rowley, B.Sc., were in charge of this district for various periods. The final computations for this report were made by S. H. Frame and E. J. Switzer.

WESTERN CYPRESS HILLS DISTRICT

This district included the following regular gauging stations:

Stream	Location	Date Established
Anderson ditch	SW. 23-6-3-4	Sept. 23, 1911
Battle creek	NE. 33-5-29-3	June 3, 1909
Battle creek	NW. 33-5-27-3*a*	July 5, 1910
Battle creek	NE. 3-3-27-3	May 11, 1910
H. T. Clark ditches	SW. 21-7-3-4	Sept. 28, 1915
Cheeseman ditches	SW. 12-8-29-3	June 24, 1911
English ditch	SW. 12-7-3-4	Sept. 29, 1915
Gaff ditch	SW. 25-5-29-3	July 11, 1911
Irrigation creek	SE. 35-5-7-4	March 21, 1911
Gilchrist ditch	SW. 11-5-27-3	October 16, 1911
Gregg ditch	NE. 34-3-29-3	July 30, 1915
D. A. Hammond ditch	NE. 5-2-29-3	August 2, 1915
Hanckel ditch	NE. 30-7-3-4	October 4, 1915
Hartt ditch	NE. 15-6-3-4	Sept. 27, 1915
Henry ditch	NW. 28-5-28-3	July 7, 1914
Henry ditch	NW. 34-5-28-3	July 7, 1914
Hooper and Huckvale North ditch	SW. 27-4-6-4	May 2, 1912
Hooper and Huckvale South ditch	NE. 22-4-6-4	March 7, 1914
Jahn ditch	SE. 8-3-29-3	July 31, 1915
Ketchum creek	NE. 25-4-7-4	May 17, 1915
Lindner ditch	NW. 10-6-29-3	July 26, 1910
Link ditches	SW. 32-5-1-4	July 25, 1914
Lodge creek	SE. 12-1-29-3	August 13, 1909
E. Br. Lodge creek	SE. 1-7-3-4	October 7, 1911
Lynch ditch	NE. 19-2-29-3	August 9, 1915
Manyberries creek	SW. 27-4-6-4*b*	June 7, 1910
Maple Creek Cattle Co. ditch	NE. 20-6-27-3	June 27, 1916
Marshall & Gaff ditch	NE. 33-5-29-3	July 11, 1911
McCann ditch	NE. 29-5-1-4	July 13, 1915
McKinnon ditch	NW. 20-4-26-3	October 20, 1911
Middle creek	SW. 30-5-29-3	July 20, 1909
Middle creek	NE. 4-2-29-3	June 13, 1910
Milk river	NE. 6-37N-9E.P.M. Montana, U.S.A.*c*	August 7, 1909
Mitchell Upper ditch	NE. 29-5-2-4	July 6, 1915
Mitchell Lower ditch	SE. 15-5-2-4	July 7, 1915
Mock ditch	NW. 21-7-2-4	Sept. 29, 1915
Muir & Frantzen ditch	SW. 36-5-2-4	July 6, 1915
Mudie ditch	NW. 21-7-3-4	Sept. 28, 1915
Mull ditches	NW. 24-7-29-3	June 9, 1915
Oxarart creek	NE. 20-6-27-3	June 15, 1909
Parsonage ditch	SW. 3-7-29-3	June 9, 1915
Peachey ditch	SE. 4-3-29-3	July 29, 1915
Read ditch from Michel coulee	NE. 33-6-3-4	Sept. 28, 1915
Read ditch from Read creek	NE. 34-6-3-4	Sept. 27, 1915
Richardson ditch	SE. 2-5-27-3	October 14, 1911
Sage creek	NE. 9-1-2-4	August 10, 1909
Sixmile coulee	SW. 6-7-28-3*d*	July 22, 1909
Spangler ditch	NW. 24-2-30-3	August 2, 1915
Spangler ditch	SW. 6-7-28-3	July 10, 1911
Stirling and Nash ditch	SE. 22-3-27-3	July 11, 1911
Suiste North ditch	NE. 9-6-3-4	Sept. 27, 1915
Suiste South ditch	NE. 4-6-3-4	Sept. 27, 1915
Wiley ditches	SW. 3-1-2-4	August 11, 1915

a This station was originally located on the SW. 2-6-28-3, but was movedto its present position on May 29, 1912.
b This station was originally located on the SE. 3-5-6-4, but was moved to its present position on May 2, 1912.
c This station was originally located on SE. 3-1-5-4, but was moved to its present position in the spring of 1913.
d This station was originally located on the NW. 29-7-28-3, but was moved to its present position on July 4, 1911.

Stream	Location	Date Established
Wilkes ditch	NW. 4-6-27-3	October 7, 1915
Wilson ditch	NE. 34-5-28-3	June 21, 1911
Wood and Anderson ditch	NE. 21-7-29-3	June 20, 1914
Wood and Anderson East ditch	SE. 22-7-29-3	June 20, 1914
Wood and Anderson West ditch	NE. 22-7-29-3	June 20, 1914

As the rainfall was above the average, several of the ditches were used very little, or not at all, during 1916.

During the fall a new gauging station, with an automatic gauge, was established on Battle creek near the international boundary. It was constructed and will be maintained, jointly by this Branch and the United States Geological Survey.

No winter records were obtained on any of the streams in this district during 1916.

Miscellaneous gaugings were made of Bare creek (SW. 25-3-1-4), Canal creek (SW. 27-3-6-4), Kennedy coulee (NE. 6-37N-9E.P.M., Mont., U.S.A.), Lodge creek (NW. 10-6-3-4, SW. 15-6-3-4, and NE. 25-3-1-4), Lost river (Sec. 2-1-4-4), S. B. Manyberries creek (SW. 7-5-5-4), Middle creek (SW. 35-5-1-4), Sexton creek (SW. 21-7-3-4), Sixmile creek (Sec. 12-8-29-3), and Tenmile creek (Sec. 4-6-29-3).

Most of the flow of the streams in this district takes place in the early spring, during the break up, and the district was covered during this period by three engineers. W. H. Rowley, B.Sc., was in charge of the work on the lower stations on Battle and Willow creeks; P. A. Fetterley, B.Sc., in charge of the work on the upper waters of Battle and Lodge creeks; and L. J. Gleeson, B.Sc., in charge of the work in the vicinity of Pakowki lake and Milk river at Spencer's lower ranch. After the end of the freshet period, Mr. Rowley was in charge of the whole district and he and J. R. Estey, B.Sc., made the final computations for this report.

Mr. Rowley also acted as Water-master in this district, but owing to the abundance of rainfall his duties as Water-master were very light.

EASTERN CYPRESS HILLS DISTRICT

This district included the following regular gauging stations:

Stream	Location	Date Established
Armstrong East ditch	SW. 9-8-24-3	October 15, 1913
Armstrong West ditch	SW. 9-8-24-3	October 15, 1913
Axton ditch	SE. 26-7-21-3	July 26, 1913
Axton North ditch	NE. 23-7-21-3	July 26, 1913
Axton South ditch	NE. 23-7-21-3	July 26, 1916
Barnett ditch	SE. 17-7-22-3	July 26, 1915
Barroby ditch	NE. 33-6-23-3	August 12, 1913
Bate creek	SW. 7-6-16-3	April 15, 1914
Bate ditches	SW. 7-6-16-3	July 28, 1913
Belanger creek	NE. 19-6-25-3*a*	March 31, 1912
Bigbreed creek	NW. 3-2-11-3*b*	March 30, 1914
Bolingbroke ditch	NE. 7-7-22-3	August 11, 1913
Bone creek	NW. 34-8-22-3	July 2, 1908
Bowrey ditch	near Barnard, Mont., U.S.A.	April 30, 1914
Clark and Thompson ditch	NE. 5-7-21-3	July 19, 1913
A. M. Cross ditch	SE. 5-8-22-3	August 14, 1913
F. Cross ditch	NW. 15-7-22-3	Sept. 9, 1911
Davis creek	NE. 29-6-25-3	May 24, 1909
Drury ditch	NW. 19-6-25-3	Sept. 2, 1914
Fairwell creek	NW. 30-6-24-3	June 10, 1909
Frenchman river	NE. 23-6-23-3	July 9, 1912
Frenchman river	SE. 31-6-21-3*c*	July 31, 1908
Frenchman river	SE. 27-5-16-3	April 10, 1914
Frenchman river	NW. 24-1-11-3*d*	March 27, 1914
N.B. Frenchman river	NE. 16-7-22-3	July 25, 1908
Horse creek	near Barnard, Mont., U.S.A.	May 1, 1914
Jones creek	SE. 20-8-20-3*e*	May 15, 1912

a This station was originally located on the SW. 30-6-25-3, but was moved to its present position on August 7, 1915.
b This station was originally located on the SE. 15-2-11-3, but was moved to its present position on April 20, 1915.
c This station was originally located on the NE. 31-6-21-3, but was moved to its present position on August 21, 1914.
d This station was originally located on the NW. 3-2-11-3, but was moved to its present position on September 22, 1915.
e A station on this stream was previous to 1912 maintained on Sec. 5-8-20-3.

Stream	Location	Date Established
Kearney ditch	SE. 19-8-23-3	Sept. 6, 1913
Lewis ditch	NW. 34-8-22-3	July 29, 1915
Littlebreed creek	NW. 11-2-11-3	March 28, 1914
McEachran creek	SW. 6-1-7-3	May 1, 1914
Morrison ditch	SW. 26-6-21-3	August 22, 1911
Mule creek	SW. 33-5-17-3	April 15, 1914
Parker ditches	SW. 4-9-20-3	July 15, 1913
D. H. Pollock ditches	NW. 22-7-21-3	August 10, 1911
Rock creek	near Barnard, Mont., U.S.A.	April 30, 1914
Snake creek	SW. 16-4-13-3	April 7, 1914
C. E. Stearns ditch	NW. 20-8-20-3	July 16, 1913
C. E. Stearns ditch	SW. 20-8-20-3	July 16, 1913
C. E. Stearns ditch	SW. 17-8-20-3	July 16, 1913
Stearns Bros. South ditch	SW. 9-9-20-3	July 21, 1915
Stearns Bros. North ditch	SW. 9-9-20-3	July 21, 1915
Strong ditch	NE. 25-6-22-3*a*	July 31, 1908
Sucker creek	NW. 24-6-26-3	May 26, 1909
Swiftcurrent creek	SW. 22-7-21-3	May 18, 1909
F. T. White ditch	SW. 12-9-22-3	July 25, 1913

Miscellaneous gaugings were made of Blacktail creek (NW. 20-6-23-3), Buzzard's ditch (NW. 11-2-11-3), Calf creek (SE. 5-8-22-3), Concrete coulee (NW. 2-7-23-3), Doyle coulee (SW. 17-7-22-3), Fireguard creek (SE. 5-3-11-3), Petrified coulee (SE. 18-7-22-3), Little Pinto creek (SE. 2-4-12-3), Police creek (SW. 30-3-11-3), Rose creek (NE. 26-7-22-3), Shotgun creek (NW. 21-4-14-3) and E. B. Snake creek (NW. 21-4-12-3).

No records of winter flow were taken in this district.

As the rainfall was a little above the average, several of the ditches were used very little, or not at all, during 1916.

Late in the fall a new station, with an automatic gauge, was established on Frenchman river near the international boundary. It was constructed, and will be maintained, jointly by this branch and the Water Resources Branch of the United States Geological Survey.

J. E. Caughey, B.Sc., had charge of the field work in this district until August 30, when he was granted leave of absence to enlist for active service overseas. M. H. French assisted during the spring break-up. After Mr. Caughey left, L. B. P. Miles was in charge of the field work for the balance of the year. The final computations for this report were, however, made by J. R. Estey, B.Sc., E. J. Switzer and H. W. Rowley, B.Sc.

MAPLE CREEK DISTRICT

This district included the following regular gauging stations:

Stream	Location	Date Established
Adams ditches	NE. 10-9-27-3	May 22, 1914
Bear creek	SE. 18-11-23-3	June 22, 1908
Beveridge East ditch	NE. 7-10-24-3	May 24, 1915
Beveridge West ditch	NW. 18-10-24-3	June 27, 1914
Boxelder creek	NE. 2-12-30-3	May 24, 1909
Braniff ditch	SE. 30-11-23-3	June 22, 1911
Bridge creek	SE. 33-10-22-3	April 8, 1911
Bridge creek	SE. 23-13-19-3	March 29, 1911
Brown ditch	NW. 31-8-3-4	October 14, 1915
Bullshead creek	SW. 4-11-5-4	May 15, 1915
Bullshead creek	SE. 16-12-5-4	July 26, 1909
Clark ditch	SE. 15-9-5-4	October 15, 1915
Cumberland ditch	SW. 17-11-24-3	June 27, 1914
Dimmock ditch	SE. 16-11-21-3	July 29, 1912
Dimmock ditch	SW. 33-11-21-3	July 4, 1915
Dixon ditch	SE. 17-12-26-3	June 4, 1911
D. Drinnan ditches	SE. 23-13-1-4	Nov. 11, 1915
J. K. Drinnan ditches	NE. 7-12-3-4	Nov. 6, 1915
Fauquier ditch	NE. 30-10-25-3	June 8, 1914
Fearon ditch	SW. 6-11-24-3	June 25, 1912
Gap creek	SE. 4-10-27-3	April 25, 1909
Gordon, Ironside & Fares ditch	NW. 7-12-22-3	June 14, 1915
Green ditch	SE. 17-14-14-3	July 2, 1915

a This station was originally located on Sec. 36-6-22-3, but was moved to its present position on April 17, 1911.

Stream	Location	Date Established
Hammond ditches	SW. 16-10-25-3	May 26, 1915
Hargrave ditch	SW. 36-12-30-3	Nov. 12, 1915
Hargrave ditch	NE. 25-12-1-4	Nov. 12, 1915
Hargrave ditch	NW. 1-13-1-4	Nov. 12, 1915
Hawkins ditch	SE. 26-9-20-3	July 9, 1913
Hay creek	SW. 29-10-25-3	July 4, 1910
MacKay creek	NW. 26-11-1-4	July 29, 1909
Mann ditch	NW. 32-10-22-3	July 1, 1915
Many Island Sheep Company ditches	NE. 11-13-1-4	Nov. 12, 1915
Maple creek	SE. 28-11-26-3	May 4, 1910
Maple creek	NE. 5-12-26-3	April 28, 1915
Martin ditch	NE. 5-11-28-3	Nov. 16, 1915
McCarthy, Bertram & Salt ditches	NW. 29-11-23-3	June 15, 1914
Moorhead ditch	SE. 25-10-25-3	June 10, 1911
Needham ditch	SW. 30-11-23-3	June 22, 1911
Notukeu creek	NW. 10-11-10-3	August 6, 1914
Peacock ditches	SW. 36-10-26-3	May 19, 1915
Piapot creek	NE. 18-11-24-3*a*	June 17, 1908
Pollock ditches	SW. 17-9-27-3	May 19, 1914
Rae ditch	NE. 24-13-6-4	October 23, 1915
Ross creek	NW. 31-11-2-4	July 28, 1909
Sevenpersons river	NE. 30-12-5-4	April 27, 1911
Sinclair ditch	SE. 18-10-19-3	July 22, 1915
Skull creek	SE. 32-10-22-3	April 8, 1911
Small ditch	NW. 26-9-28-3	Nov. 22, 1915
Small ditch	SE. 22-9-27-3	Nov. 22, 1915
South Saskatchewan river	NW. 31-12-5-4	May 31, 1911
Starks & Burton ditch	SE. 17-11-5-4	October 9, 1911
Swiftcurrent creek	NE. 18-10-19-3	June 15, 1910
Swiftcurrent creek	NW. 17-10-19-3	May 27, 1910
Swiftcurrent creek	SW. 12-15-14-3	Jan. 16, 1914
Swiftcurrent creek	NW. 18-15-13-3*b*	April 30, 1910
Tranter North ditch	SW. 18-10-24-3	May 20, 1915
Tranter South ditch	NW. 5-10-24-3	May 20, 1915

Miscellaneous gaugings were made of E. B. Bear creek (NE. 29-10-23-3), W. B. Bear creek (NW. 29-10-23-3), Gap creek (NE. 28-11-26-3 and SE. 30-11-26-3), E. B. Mackay creek (NW. 14-11-1-4), W. B. Mackay creek (NW. 14-11-1-4), McShane creek (SE. 4-10-27-3), Piapot creek (SE. 25-10-25-3 and SE. 36-10-25-3), and Spring coulee (SE. 8-11-23-3).

No winter records were taken, except of the South Saskatchewan river, Swiftcurrent creek (two stations) and Notukeu creek. The first mentioned was included in the Macleod district during the winter and the two latter in the Saskatoon district.

As the rainfall was a little above the average, several of the ditches were not used at all during 1916.

E. J. Switzer was in charge of this district during 1916. He was assisted in the final computations for this report by J. R. Estey, B.Sc.

SASKATOON DISTRICT

This district included the following regular gauging stations:

Stream	Location	Date Established
Battle river	NW. 25-43-17-3*c*	May 23, 1914
Long creek	SE. 10-2-8-2	June 22, 1911
Moosejaw creek	NE. 24-11-19-2	June 21, 1911
Moosejaw creek	NW. 16-16-26-2	April 7, 1910
Moose Mountain creek	NE. 15-3-2-2	Sept. 4, 1913
North Saskatchewan river	SW. 33 and NE. 29-43-16-3	May 16, 1911
North Saskatchewan river	River Lot 76, Prince Albert Settlement	October 2, 1911
Qu'Appelle river	NW. 33-19-21-2	May 12, 1911

a This station was originally located on the SW. 17-11-24-3, but was moved to its present position on May 13, 1909.

b This station was originally located on the SW. 30-15-13-3, but was moved to its present position on May 5, 1913.

c A station was previously maintained on this stream on the SE. 19-43-17-3.

Stream	Location	Date Estafllished
Souris river	SE. 20-8-14-2	May 17, 1916
Souris river	NE. 11-2-8-2	June 23, 1911
Souris river	NE. 36-2-1-2	June 26, 1911
South Saskatchewan river	SW. 28-36-5-3	May 27, 1911
Spring creek	SE. 30-32-15-2	August 1, 1916
Springs	NE. 17-17-28-2	August 17, 1916
Spruce river	SW. 26-49-26-2	July 14, 1915

Winter records were obtained on all the regular stations in this district, except one station on Moosejaw creek (NE. 24-11-19-2), Moose Mountain creek and Souris river (NE. 36-2-1-2). Two gauging stations on Swiftcurrent creek, near Swift Current, and Notukeu creek at Vanguard, were included in this district during November and December.

F. R. Shenstone, B.E., was in charge of the field work in this district, except for about six weeks, when he was relieved by J. R. Estey. The final computations for this report were made by F. R. Shenstone, B.E., J. R. Estey, B.Sc., V. A. Newhall, B.A.Sc., W. E. G. Hall, B.Sc., and C. S. Dewis.

EDMONTON DISTRICT

This district included the following regular gauging stations:

Stream	Location	Date Established
Athabaska river	SE. 20-66-22-4	Feb. 27, 1913
Battle river	SW. 4-43-25-4	May 7, 1913
Blindman river	NE. 16-39-27-4	July 1, 1914
Clearwater river	SE. 16-39-7-5	June 3, 1913
Hastings creek	SE. 23-51-20-4	April 28, 1916
North Saskatchewan river	NE. 21-39-7-5	June 2, 1913
North Saskatchewan river	River Lot No. 17, Edmonton Settlement, NW. 33-52-24-4	May 1, 1911
Pigeon creek	SE. 15-46-28-4	July 13, 1914
Red Deer river	SE. 20-38-27-4	Dec. 2, 1911
Sturgeon river	Bet. River Lots 27 and 52, St. Albert Settlement	April 23, 1913
Sturgeon river	NW. 28-55-22-4	Dec. 30, 1913

All stations in this district were maintained throughout the winter, except Pigeon creek and Sturgeon river at St. Albert. The district was, however, divided and included in the Peace River, Jasper and Calgary districts during the winter.

Flood prediction stations were maintained on the North Saskatchewan river at Rocky Mountain House and Edmonton. The observers at these stations telegraphed the gauge height to the office once or twice a day, and when these reports showed the danger of a flood on the lower reaches of the river, a warning was sent out to public officials in the locality threatened by floods. The river did not get nearly so high in 1916 as in 1915 and no great damage was done. The daily reports, however, removed any undue alarm caused by unreliable reports.

C. M. O'Neil, B.A.Sc., was in charge of this district until May 16, when H. S. Kerby, B.A.Sc., was placed in charge. On September 20, Mr. Kerby was granted leave of absence to go on active service overseas, and the Edmonton district was divided and included in the Calgary, Jasper and Peace River districts. C. S. Dewis and W. H. Storey made the final computations for the annual report.

NORDEGG DISTRICT

This district included the following regular gauging stations:

Stream	Location	Date Established
Bighorn river	Sec. 18-39-16-5	June 14, 1915
Blackstone river	Sec. 18-43-16-5	June 27, 1915
Brown creek	Sec. 2-44-17-5	June 27, 1915
Chungo creek	Sec. 13-43-17-5	June 27, 1915
Cline river	Sec. 7-37-18-5	June 18, 1915
Martin creek	Sec. 27-40-15-5	June 12, 1915
Mistaya river	Sec. 33-34-20-5	June 27, 1915
North Saskatchewan river	Sec. 23-36-18-5	May 15, 1915
North Saskatchewan river	Sec. 14-40-13-5	August 4, 1915
Ram river	Sec. 13-39-11-5	June 27, 1915
Shunda creek	Sec. 21-40-13-5	June 1, 1915
Siffleur river	Sec. 31-35-17-5	May 17, 1915
Whiterabbit creek	Sec. 23-36-18-5	May 16, 1915

Miscellaneous measurements were made of Bighorn river (Sec. 33-39-17-5), Clearwater river (Sec. 29-35-11-5, Sec. 19-34-12-5 and Sec. 13-33-15-5), Coral creek (Sec. 12-37-19-5), Pinto creek (Sec. 33-36-21-5), Ram river (Sec. 2-38-12-5), N. Fork Ram river (Sec. 25-38-15-5), S. Fork Ram river (Sec. 9-35-15-5 and Sec. 19-36-13-5), Saunders creek (Sec. 24-40-13-5) and Whiterabbit creek (Sec. 9-35-16-5).

As the district is only very sparsely settled, gauge observers could only be obtained at the stations on Martin creek, Shunda creek and the lower station on the North Saskatchewan river. An automatic gauge was used at the upper station on the North Saskatchewan river.

Winter records were obtained on the North Saskatchewan river (both stations), Martin creek, and Shunda creek.

O. H. Hoover, B.A.Sc., was in charge of this district until May 28, 1916, when he was granted leave of absence to enlist for active service overseas. C. M. O'Neil, B.A.Sc., was in charge of the district for the balance of the year and made the final computations for the annual report.

JASPER DISTRICT

This district included the following regular gauging stations:

Stream	Location	Date Established
Athabaska river	NW. 15-45-1-6	March 4, 1913
Athabaska river	SE. 8-51-25-5	May 4, 1915
Lobstick river	NE. 30-53-7-5	July 11, 1913
Maligne river	SW. 1-46-1-6	June 17, 1914
McLeod river	NW. 3-54-16-5	May 18, 1914
Miette river	SW. 9-45-1-6	May 23, 1913
North Saskatchewan river	NE. 10-49-7-5	June 20, 1915
Pembina river	SW. 20-53-7-5	May 8, 1914
Rocky river	NW. 13-48-28-5	July 3, 1913
Snake Indian (Stony) river	NW. 26-48-28-5	August 8, 1916

Miscellaneous gaugings were made of Embarras river (SW. 5-52-18-5), Fiddle river (SE. 15-49-27-5), Happy creek (SE. 14-51-25-5), Hardisty creek (SE. 24-51-25-5), Maligne river (above gorge), Muskeg creek (SW. 15-54-16-5), Prairie creek (SE. 5-51-25-5), Snaring river (NW. 33-46-1-6), Sundance creek (SW. 3-53-18-5), and Wolf creek (SW. 3-54-16-5).

Winter records were obtained at all stations in this district.

It being impossible to secure an observer, an automatic gauge was installed on Maligne river on June 3, 1916. A new cable was also installed on the North Saskatchewan river at Rocky rapids.

R. J. McGuinness, Charles McGavin and W. T. Reeve were in charge of the field work for various periods and R. J. McGuinness, C. S. Dewis and W. H. Storey made the final computations for the annual report.

PEACE RIVER DISTRICT

This district included the following regular gauging stations:

Stream	Location	Date Established
Harmon river	NW. 29-83-21-5	May 31, 1915
Lesser Slave river	SW. 7-73-5-5	May 20, 1915
Peace river	NE. 30-83-21-5	May 26, 1915
Peace river	SE. 23-108-13-5	August 8, 1915
Smoky river	SW. 10-78-24-5	June 2, 1915
Swan river	NE. 23-72-10-5	May 19, 1915

Gauges are also maintained on Lesser Slave Lake on Sec. 19-75-14-5 and SW. 15-73-6-5.

Miscellaneous gaugings were made of Bear creek (NW. 16-81-6-6), Big Rat creek (NW. 11-80-5-6), Burnt river (SE. 7-80-1-6), Montagneuse river (NW. 31-83-6-6), Patch creek (SW. 32-83-21-5), Heart river (SW. 31-75-16-5), East Prairie river (SW. 11-74-16-5), West Prairie river (SW. 14-74-17-5), Red river (Tp. 108-5-5), Spirit river (NW. 12-78-6-6) and Wabiskaw river (Tp. 108-9-5).

In order to get good records of the winter flow of Peace river at the Vermilion chutes, it was arranged for P. H. Daniells, B.Sc., to spend the winter of 1915-16 at Fort Vermilion, the nearest settlement to the chutes. Mr. Daniells left Peace River on December 1, 1915, and arrived at Fort Vermilion on the 14th idem. During the winter he made two or three observations of the gauge per day and two or three discharge measurements per week, except for two short periods when he made reconnaissance trips to the chutes and made gaugings of Peace river there, and of the tributaries in that locality. A local resident made observations at Fort Vermilion during Mr. Daniells' absence. Mr. Daniells left Fort Vermilion again on April 8, and returned to Peace River on the 29th idem.

Winter records were also obtained at all the rest of the regular gauging stations in this district except Swan river. C. M. O'Neil was in charge of these and certain other stations in the Edmonton district from the first of January to the end of April.

Mr. Daniells was placed in charge of the whole district in May and remained in charge until he tendered his resignation and was relieved by Charles McGavin on September 6. Mr. McGavin remained in charge for the balance of the year and when winter conditions started in November, he discontinued records of Swan river and included some of the stations formerly in the Edmonton district in his district for the winter.

The final computations for the annual report were made by A. B. Cook, Charles McGavin and C. S. Dewis.

SPECIAL INVESTIGATIONS

During 1916 an effort was made to continue the study of the absorption losses in the larger irrigation canals. No suitable section could, however, be found in the Canadian Pacific Railway Company's Bow river schemes because of repairs to structures, but careful physical examinations were made and sections selected for investigation at some later date when time and circumstances will permit of the work being done. Climatic conditions and the method of operating the farm deliveries made it impossible, without a considerable expenditure for automatic gauges, to go any further with the investigations on the Alberta Railway and Irrigation Company's canals. The work will be simpler and the results more satisfactory in years when the precipitation is below the average. Being fairly high in 1916, there was always a certain amount of drainage into the canals which offset the absorption losses. This work was done by Messrs. L. E. Kendall, B.Sc., and R. J. McGuinness.

Messrs. L. E. Kendall and R. J. McGuinness also spent about six weeks during the fall in the field investigating absorption losses in Milk river between the town of Milk River and the mouth of Deer creek. This was done in about the same manner as the investigations in canals. By the use of current-meters and automatic water stage registers, continuous records of the flow at each end of a section were obtained, and the absorption losses in cubic feet for a certain period were obtained.

BENCH-MARKS

When the stream measurement work was first started, the gauges were usually referred to bench-marks on wooden stakes or stumps of trees. These were easily shifted or destroyed and were not satisfactory. In 1911 an iron bench-mark was adopted by this branch and now almost all the gauges are either referred to bench-marks on concrete piers or other permanent structures, or to one of these iron bench-marks. Whenever an opportunity is afforded, these are tied to some railway or Dominion Government system of levels, to determine their elevation above sea level, and they are therefore also a convenient reference for local levelling operations.

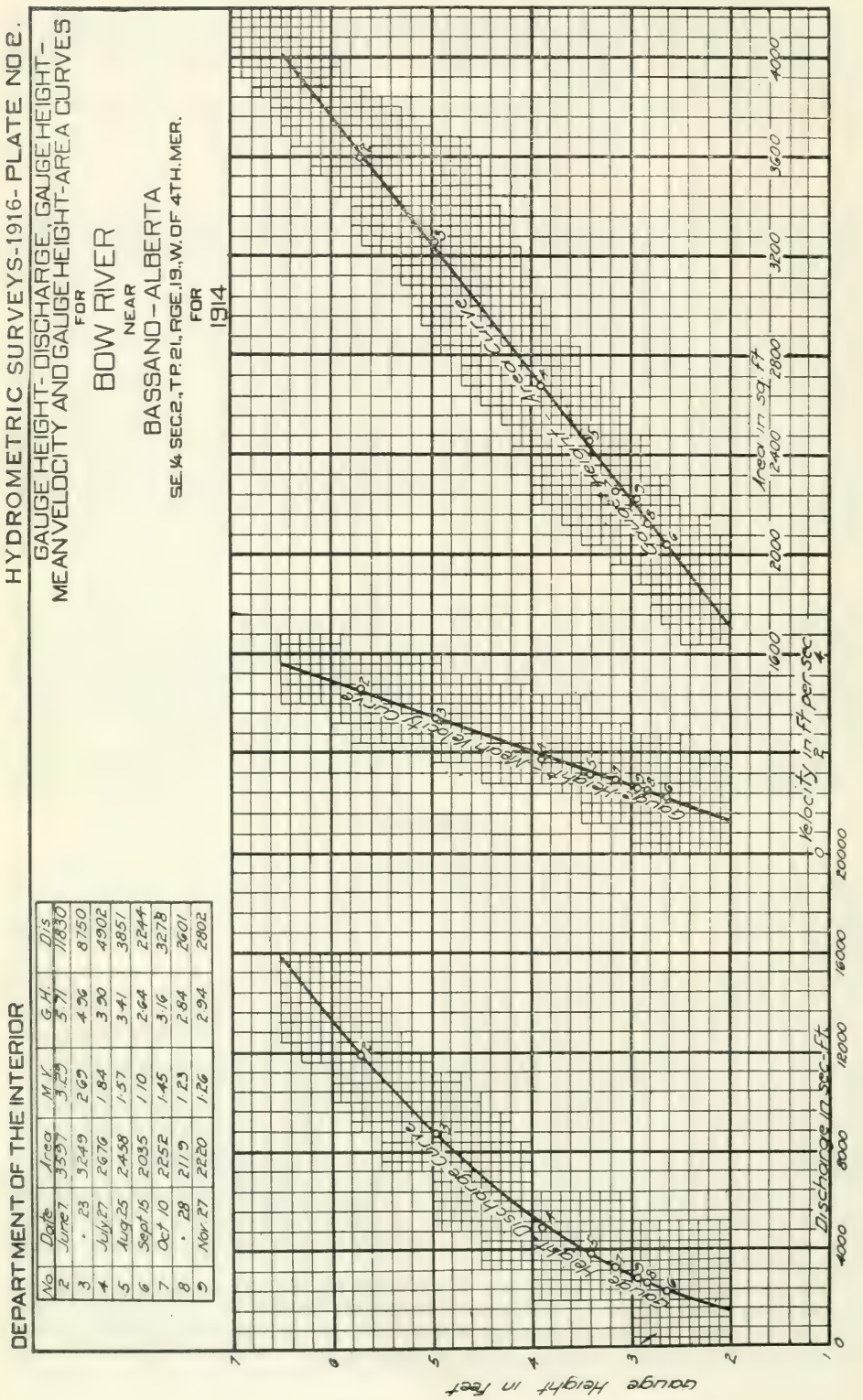
Description of the iron bench-marks are given in the Report of the Progress of Stream Measurements for 1911 and 1912.

OFFICE WORK

As above intimated, the reports of the gauge height observers and the engineers are transmitted to the office by mail. These are copied to office forms and filed in a cabinet, which is carefully indexed and where they can be referred to at any time without trouble. As the engineers complete their final computations, the results are entered on convenient forms and filed in the same cabinet.

A cabinet made up of four styles of drawers is used for filing the records. The top section is used for filing the gauge height books of the observers and the current-meter notes of the engineers. The gauge height books and current-meter notes are filed alphabetically, according to the names of the streams. The next section contains the postal cards sent in by the observers and these are also filed alphabetically according to the names of the streams. The third section is made up of map drawers and contains the gauge height-area, gauge height-mean velocity and gauge height-discharge curves, and plotted cross-sections which are filed alphabetically, according to the names of the streams. The same section contains the maps showing the outlines of the drainage basins, filed numerically according to the number of the sectional sheet. The rating curves for the current-meters are also filed in this section numerically, according to the office numbers of the current-meters. The bottom section of the cabinet consists of letter size pockets, alphabetically arranged for each gauging station. The tables of gauge heights, discharge measurements, daily gauge height and discharge, monthly discharge, a description of the station and memorandum of any changes are filed in these pockets. The different rating tables for each meter are also filed numerically in this section and another drawer contains the daily and monthly reports of the meteorological service.

The copying and filing of the reports of the gauge height observers and the engineers is entrusted to an office recorder. While doing this he carefully examines all records to see that there are no errors, and where there are doubtful or impossible records it is his duty to have the data corrected or ascertain the cause of the unusual conditions. He also makes out the pay list for the observers and conducts the correspondence relating to the records.


DEPARTMENT OF THE INTERIOR
HYDROMETRIC SURVEYS-1916- PLATE NO 2.
GAUGE HEIGHT- DISCHARGE, GAUGE HEIGHT- MEAN VELOCITY AND GAUGE HEIGHT-AREA CURVES
FOR
BOW RIVER
NEAR
BASSANO-ALBERTA
SE. ¼ SEC. 2., TP 21, RGE. 19, W. OF 4TH. MER.
FOR
1914
No | Date | Area | M.V. | G.H. | Dis
2 | June 7 | 3597 | 3.29 | 5.91 | 11830
3 | " 23 | 3249 | 2.69 | 4.36 | 8750
4 | July 27 | 2676 | 1.84 | 3.30 | 4902
5 | Aug 25 | 2458 | 1.57 | 3.41 | 3851
6 | Sept 15 | 2035 | 1.10 | 2.64 | 2244
7 | Oct 10 | 2252 | 1.45 | 3.16 | 3278
8 | " 28 | 2119 | 1.23 | 2.84 | 2601
9 | Nov 27 | 2220 | 1.26 | 2.94 | 2802
Gauge Height in Feet
Discharge in Sec. Ft.
Velocity in Ft. per Sec.
Area in Sq. Ft.
Gauge Height Discharge Curve
Gauge Height Velocity Curve
Gauge Height Area Curve

All computations are checked before being used or published. For this reason, as far as possible, men with some technical education, or students in science, are engaged as helpers. The discharge measurements are computed by the helper and his work is checked by the engineer. In some instances where there is a great deal of driving and camping out, the engineer cannot secure a helper who can compute discharges, and in that case he computes the discharges himself and his computations are checked in the office by the office recorder.

When the territory was divided into two divisions at the beginning of 1916, J. B. Gray was appointed office recorder for the Northern Division, and W. K. Broughton for the Southern Division. When Mr. Broughton was placed in charge of the Calgary district in April, W. Meldrum was appointed office recorder for the Southern Division. Mr. Meldrum, however, enlisted with the Militia in May and W. A. Hanton was employed as office recorder for the Southern Division and retained the position for the balance of the year.

The results of the discharge measurements are plotted on cross-section paper as soon as they are received in the office. In this way a very close check is kept on the records and errors can be detected at once and in most cases can be rectified. At the same time the records are kept up to date and demands for provisional estimates can be met at an early date. Important changes in the flow are also detected at once and instructions are issued without delay to the field engineers to obtain further gaugings. This work is done by the Office Hydrometric Engineer. A. B. Cook filled this position for the Northern Division during 1916. F. K. Beach, A. M. Can. Soc. C.E., was appointed for the Southern Division but enlisted for active service overseas in May, and J. R. Estey, B.Sc., was employed as his substitute for the balance of the year.

G. H. Whyte was appointed Divisional Hydrometric Engineer in charge of the Southern Division, but enlisted for active service overseas in March, and was succeeded by V. A. Newhall, B.A.Sc. N. M. Sutherland, Grad. R.M.C., was appointed Divisional Hydrometric Engineer for the Northern Division, but enlisted with the Militia in March and was succeeded by W. H. Storey. The divisional hydrometric engineers exercise direct supervision over the field and office work by constantly checking and inspecting it. They also do considerable work in the preparation of the annual and special reports.

P. M. Sauder, D.L.S., M. Can. Soc. C.E., occupies the position of Chief Hydrometric Engineer and exercises general supervision over the survey.

Misses N. Robinson and J. Golder make up the balance of the office staff. I. R. Strome, B.A.Sc., one of the field engineers, however, worked in the office on final computations and general office work until April 30, when he was granted leave of absence to enlist for active service overseas.

FUTURE WORK

During 1917, a special effort is being made to again obtain the total spring run-off of the main streams in the Cypress hills and of Pakowki Lake drainage basin. The records obtained in former years on these streams are of special value and no doubt those of 1917 will be a valuable addition.

While the districts will be re-arranged and a few unimportant stations discontinued, most of the regular work will be continued during 1917. In view, however, of the desirability to curtail expenditures as much as possible, no new work is likely to be undertaken.

During recent years the district hydrometric engineers also acted as water-masters in the Cypress Hills districts, but the irrigation inspections have always been made by other engineers specially assigned to that work. This year, however, the Cypress Hills country is divided into smaller districts, and one engineer is to do all the work in the district. This engineer is also to advise and assist farmers in applying water to their land. He will, therefore, really fill four positions, namely, District Hydrometric Engineer, Inspecting Engineer, Water-master and Agricultural Engineer. Having a small district, he can spend most of his time in the localities where most of the water is used, get better records and be of greater service to the public. There will be less travelling and no increase in staff, so there should be a reduction in the total expenses.

The same method will be adopted in Southern Alberta, and in the Macleod district a motor car is to be used for the first time on this work.

If conditions are favourable some further investigations will be made of absorption losses in irrigation canals, but it is not likely that there will be much time or staff available for this work during 1917.

DEFINITIONS

The volume of water flowing in a stream is known as run-off or discharge. In expressing it various units are used, depending upon the kind of work for which the data are needed. Those used in this report are "second-foot," "acre-foot," "run-off per square mile" and "run-off in depth in inches," and may be defined as follows:

"Second-foot" is an abbreviation for cubic foot per second, and is the body of water flowing in a stream one foot wide and one foot deep at the rate of one foot per second.

The "acre-foot" is the unit capacity used in connection with storage for irrigation work and is equivalent to 43,560 cubic feet. It is the quantity required to cover an acre to a depth of one foot.

The expression "second-feet per square mile" means the average number of cubic feet of water flowing each second from every square mile of drainage area on the assumption that the run-off is uniformly distributed.

"Depth in inches" means the depth of water in inches that would have covered the drainage area, uniformly distributed, if all the water could have accumulated on the surface. This quantity is used for comparing run-off with rainfall, which quantity is usually given in depth in inches.

It should be noticed that "acre-feet" and "depth in inches" represent the actual quantities of water which are produced during the periods in question, while "second-feet", on the contrary, is merely a rate of flow per second.

EXPLANATION AND USE OF TABLES

The data obtained and the estimates made therefrom have been compiled in tabluated form and for each regular gauging station are given, as far as available, the following data:

1. Description of station.
2. List of discharge measurements.
3. Table of daily gauge heights and discharges.
4. Table of monthly discharges and run-off.

The description of stations gives such general information about the locality and equipment as would enable the reader to find and use the station. It also gives, as far as possible, complete history of all the changes that have occurred since the station was established and that might effect the records in any way.

The list of discharge measurements gives the results of all the discharge measurements that have been made at or in the vicinity of the gauging station or have been used in completing the records for the gauging station. It gives the date on which the measurement was made, the name of the engineer, the width and area of cross-section, the mean velocity of the current, the gauge height and the discharge in second-feet.

The table of daily gauge heights and discharges given in this report is a combination of two tables kept in the office of the survey, namely, the table of daily gauge heights and the station rating table. The table of daily gauge heights gives the daily fluctuations of the surface of the water above the zero of the gauge, as reported by the observer. During high water, two observations of the gauge were made at some stations and the gauge height given in the table is the mean of the observations for the day. Where automatic gauges are maintained the records given are the mean stage for the day. The discharge measurements and gauge heights are the base data from which the other tables are computed. The table of daily discharges is the discharge in second-feet, corresponding to the stage of the stream, as given by the station rating table.

In the table of monthly discharge the column headed "MAXIMUM" gives the mean flow for the day when the mean gauge height was highest. As the gauge height is the mean for the day, there might have been short periods when the water level and the corresponding discharge were higher than given in this column. Likewise, in the column "MINIMUM" the quantity given is the mean flow for the day when the mean gauge height was lowest. The column headed "MEAN" is the average flow for each second during the month. The computations for the quantities in the remaining columns have been based upon this mean. The drainage area for each gauging station was marked off on the sectional maps of the department and the area taken off with a planimeter. In many districts information regarding topographical features is very incomplete and the computed areas are only approximate. As the surveys of the department are extended and completed, these computations will be checked and, if necessary, corrected.

In this report a table, called the *Historic Summary*, has been added to the records for each regular gauging station that has been in operation for four years or more. It gives the discharge for each month in second-feet, the average of the discharges for the same month in each year of the whole period in second-feet and acre-feet, and the total discharge for the climatic year (October to September) in acre-feet. This table is a convenient summary of all the records secured to date at the older stations, and will no doubt be a very great convenience to busy men and those who did not receive copies of the earlier reports.

Some of the summaries in the basins of the St. Mary and Milk rivers and tributaries are arranged according to calendar years and in these cases the figures which are ignored in calculating the monthly means are printed in italics.

CONVENIENT EQUIVALENTS

The following is a list of convenient equivalents for use in hydraulic computations:

1 cubic foot equals 6.23 British Imperial gallons.
1 cubic foot equals 7.48 United States gallons.
1 acre equals 43,560 square feet; equals 4,840 square yards.
1 acre-foot equals 43,560 cubic feet.
1 acre-foot equals 271,472 British Imperial gallons.

1 acre-foot equals 325,850 United States gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-feet per year.
1 second-foot equals 6.23 British Imperial gallons per second; equals 373.8 gallons per minute; equals 538,272 gallons for one day.
1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,272 gallons for one day.
1 second-foot equals about 1 acre-inch per hour.
1 second-foot for one day equals 1.983 acre-feet.
1 second-foot for one 28-day month equals 55.54 acre-feet.
1 second-foot for one 29-day month equals 57.52 acre-feet.
1 second-foot for one 30-day month equals 59.50 acre-feet.
1 second-foot for one 31-day month equals 61.49 acre-feet.
1 second-foot for one 153 days equals 303.47 acre-feet.
1 second-foot for one year equals 724 acre-feet.
1 second-foot for one 28-day month covers 1 square mile 1.041 inches deep.
1 second-foot for one 29-day month covers 1 square mile 1.079 inches deep.
1 second-foot for one 30-day month covers 1 square mile 1.116 inches deep.
1 second-foot for one 31-day month covers 1 square mile 1.153 inches deep.
1 second-foot for 153 days covers 150 acres 24,278 inches or 2.023 feet deep.
1 second-foot for one year covers 1 square mile 13,572 inches or 1.131 feet deep.
100 British Imperial gallons per minute equals 0.268 second-feet.
100 United States gallons per minute equals 0.223 second-feet.
1,000,000 British Imperial gallons per day equals 1.86 second-feet.
1,000,000 United States gallons per day equals 1.55 second-feet.
1,000,000 British Imperial gallons equals 3.68 acre-feet.
1,000,000 United States gallons equals 3.07 acre-feet.
1,000,000 cubic feet equals 22.95 acre-feet.
1 foot per second equals 0.682 miles per hour.
1 cubic foot of water weighs 62.5 pounds.
1 horse-power equals 550 foot-pounds per second.
1 horse-power equals 746 watts.
1 horse-power equals 1 second-foot falling 8.80 feet.
1½ horse-power equals 1 kilowatt.
1 British Columbia miner's inch equals 1.68 cubic feet per minute, or 1 second-foot approximately equals 35.7 British Columbia miner's inches.

To calculate water-power quickly: $\frac{\text{sec.-ft. x fall in feet}}{11} =$ net horse-power on water wheel, realizing 80 per cent. of the theoretical power.

To find the number of acre-feet required for a certain acreage under the prescribed duty of water of one hundred and fifty acres for each cubic foot of water per second flowing continuously during the irrigation season (153 days), multiply the acreage by 2.02314.

METHODS OF MEASURING STREAM FLOW

There are three distinct methods of determining the surface flow of streams: (1) by measurements of slope and cross-section and the use of Chezy's and Kutter's formulae; (2) by means of weirs, which include any device or structure that by measuring the depth on a crest or sill of known length and form, the flow of water may be determined; (3) by measuring the velocity of the current and the cross-section. The third method is the one most commonly used by this survey. The second is used when the flow is too small to be accurately determined by the third, while the first is only used in making estimates of the discharge of a stream when the only data available are the cross-section and slope.

Slope Method of Determining Discharge.—The slope of a stream, or rather of a section of a stream, is the difference in elevation between the upper and lower ends of the section, commonly called the fall, divided by the distance or the length of the section. Slope sections vary in length from a few hundred feet to several thousand feet, depending largely upon the nature of the stream.

It is difficult to ascertain accurately the slope of the water surface in a stream, since in nearly all streams there are pulsations in the water, causing the surface to rise and fall locally. In most streams the slope of the bottom is far from uniform, and the flow of water in any given section is more or less influenced by the flow in the adjacent section, above or below. For this reason it is a good plan to consider a number of adjacent sections, comprising a considerable length of the stream in one computation, being careful to take into account the diversity of cross-section at various places in the length, and the fact that the slope of the water surface of a stream becomes more uniform during high water and flood stages.

In determining the slope of the surface of a stream, levels are taken of the water surface at each end of the slope section, and referred to some datum or bench-mark. A good plan is to set firmly a stout wooden stake below the water surface at each end of the slope section, and then to drive a nail into the top of each stake, so that the nail-head will exactly coincide with the water surface. The difference in elevation between the two nail-heads, divided by the distance between the stakes, will give the slope.

The wetted perimeter is that portion of a stream channel that is in contact with the water. The form or outline of the wetted perimeter of a stream has an important influence upon the velocity of the current. It is usually determined graphically from the plotted cross-section or may be measured by means of a flexible tape or chain after the flood has subsided.

The hydraulic radius, which is sometimes called the mean radius of the channel below the water surface is found by dividing the area of the cross-section (in sq. ft.) by the length of the wetted perimeter (in feet).

The Chezy formula, which is the fundamental formula for stream discharge, is:

$$Q = A\,V$$

in which
Q = the discharge of the stream in sec.-ft.
A = the area of the cross-section in sq. feet
V = the mean velocity of flow, in ft. per sec.

In applying this formula to the determination of stream discharge, the mean velocity of a stream is considered a function of the slope and of the wetted perimeter of the stream. This may be expressed by formula as follows:

$$V = C\sqrt{rs}$$

in which
r = the hydraulic radius of the channel.
s = the surface slope.
and
C is a variable coefficient, depending upon the nature of the channel.

In determining the value of C for any given case it is customary to make use of Kutter's formula, which is:

$$C = \frac{41.6 + \dfrac{.00281}{s} + \dfrac{1.811}{n}}{1 + \left(41.6 + \dfrac{.00281}{s}\right)\sqrt{\dfrac{n}{r}}}$$

In this formula r and s have the same significance as in the Chezy formula and the new factor n is called the coefficient of roughness. It is a variable coefficient, and its value is dependent upon the size, shape, slope and degree of roughness of the channel. Tables of values of n are given in various text books, but it is difficult to choose the correct value. It is therefore advisable, whenever possible, to compute the value of n from a measured discharge. As the slope method of determining discharge is seldom employed except to estimate flood discharge, a current-meter measurement is very often made at the slope section, during low water. Having determined the mean velocity, slope and hydraulic radius at the time of the metering, the value of C may be found from the formula $V = C\sqrt{rs}$ or $C = \dfrac{V}{\sqrt{rs}}$. Trautwine's Pocket Book for Civil Engineers and other texts contain tables giving the value of n for different values of r, s and c. From these tables we can interpolate the proper value of n for a particular section of the stream, at low water stage. In most cases this value of n is applicable to high water and flood conditions of the stream also, and is used with values of r and s for the high water or flood cross-section to determine the value of C at the higher stage. Having determined the value of C the computation of the discharge is simple.

The results obtained by the slope method are in general only roughly approximate, owing to the difficulty in obtaining accurate data and the uncertainty of the value of n to be used.

Weir Method of Determining Discharge.—As yet few permanent weirs have been constructed by this survey, but many regular weir measurements are made on small sterams by means of a temporary weir. The weir used consists of a wooden base of 2-inch plank, to which is bolted a rectangular notch of three-eighths inch steel with bevelled edges.

In making a measurement by means of a temporary weir, the following directions should be followed as far as possible. The weir should be placed perpendicular and at right angles to the bed of the stream with the crest level. The discharge should be free in so much as the nappe should have sufficient fall to allow air to have free circulation underneath it, and the head or depth on the crest should not exceed one-third of the length. The channel of approach should be several times as wide as the opening and the depth of water in the bay or pond should be at least twice the head on the weir, so as to eliminate velocity of approach and cross-currents. In choosing a site for a weir, a point should be chosen that will fulfil the above conditions and give a good-sized bay or pond.

To set up a temporary weir, a dam of sods and earth is thrown across the stream, the weir is set in place and the sods are tramped firmly around it to stop all leakage. On a stream with a sandy bed, sods or clay must be placed on the bottom for a few feet upstream to form a mattress to prevent the undermining of the dam.

After the bay has filled up, the head of the water is observed by taking the difference in elevation of the crest of the weir and the elevation of the water surface in the bay at a distance of four to ten feet from the weir, with an engineer's level. Two common methods of getting the elevation of the water surface are: (1) hold the levelling rod on a stone or other solid body under water and subtract the depth of water on the rod from the sight on the rod; (2) drive a pin divided into tenths of feet into the bed of the stream so that an even tenth is level with the surface of the water, then hold the levelling rod on the top of the pin and add the length of pin above the water to the sight on the rod.

When the head of water has been determined, the discharge is computed by using one of the standard formulae which will suit the case. Tables giving the discharges for different heads and lengths of crests are published in many engineering texts.

The formula used by this survey for rectangular sharp-crested weirs is:

$Q = 3.33 \quad (L - .2H) \quad H^{3}/_{2}$ being a modification of Francis' formula, to allow for end contractions and elimination of velocity of approach.

in which Q = discharge in sec.-ft.; L = length of crest in feet; H = head in feet.

Measurements by means of temporary weirs should be made some distance above or below the gauge. If they are made close to a gauge, the gauge must be read before the weir is placed in the stream, and the pond must be allowed to run off after the weir is removed before the gauge is re-read.

Where permanent weirs are installed, the gauge height observed is that of an auxiliary gauge above the weir, which is kept so that the head of the weir can be read direct. The weir is not usually placed so that it will interfere with the regular station, so that if at any time the weir is destroyed the regular gauge can be read during the period that the weir is out of order.

Velocity Method of Determining Discharge.—There are two methods of determining the velocity of flow of a stream, namely, direct and indirect. In the direct method, by which the velocity is determined by means of floats, the liability of error is large, and the results far from satisfactory. This method is seldom used except for very rough estimates, or when a current-meter cannot be used. There are three common kinds of floats, viz.: surface, sub-surface and tube or rod floats. In each the procedure is the same. A straight piece of channel is selected for the run and two cross-sections are taken at some convenient distance apart, usually from 100 to 200 feet. They are then divided into strips by means of a tagged wire. The velocity in each strip is then measured by noting the time taken by the float in traversing the run or distance between the two cross-sections. As the time and distance are both known, the velocity can easily be computed. The velocity, whether measured by surface, sub-surface or tube floats, must be multiplied by a coefficient less than unity to reduce to the mean velocity before being used to compute the discharge.

The indirect or current-meter method is the most reliable and most widely used method of determining the velocity of the flow of a stream. The meter used by this survey is the Price patent, manufactured by W. & L. E. Gurley, Troy, N.Y. It consists of six cups attached to a vertical shaft, which revolves on a conical hardened steel point when immersed in moving water. The number of revolutions is indicated electrically. The rating or relation between the velocity of the moving water and the revolutions of the wheel is determined for each meter by drawing it through still water for a given distance at different speeds and noting the number of revolutions for each run. From this data a rating table is prepared which gives the velocity per second of moving water for any number of revolutions in a given time interval.

In making a measurement with a current-meter, a number of points, called measuring points, are measured off above and in the plane of the measuring section, at which observations of depth and velocity are taken. These points are spaced equally for those parts of the section where the flow is uniform and smooth, but should be spaced unequally for other parts according to the discretion and judgment of the engineer. In general, the points should not be spaced farther apart than five per cent of the distance between piers, nor farther apart than the approximate mean depth of the section at the time of measurement.

The measuring points divide the total cross-section into elementary strips, at each end of which observations of depth and velocity are made. The discharge of any elementary strip is the product of the average of the depths at the ends, the width of the strip, and the average of the mean velocities at two ends of the strip. The sum of the discharges of the elementary strips is the total discharge of the stream.

The accuracy of a discharge measurement taken at a velocity area station is dependent on two factors, the accuracy with which the area of the cross-section and the mean velocity of the flow normal to that section are measured. The greatest, and the most common errors in measurements of discharge are caused by erroneous soundings. Errors in soundings by weight and line are due to the weight being carried down stream, or, sometimes to the bowing of the line. Both these causes make the soundings too great. Errors in soundings with rods are due to the rod not being perpendicular, to the water rising on the rod, and to the rod sinking in the bed. In order to verify the accuracy of soundings made at medium or high stages they should be compared with those at low water. The mean velocity is also very difficult to measure accurately, because it is constantly changing. It varies not only from the surface to the bottom, but from one bank of the stream to the other, making it necessary to measure it at a number of points.

METHODS OF DETERMINING MEAN VELOCITY

There are a number of different methods of determining the mean velocity at the ends of these strips, or, as it is commonly called, the mean velocity in a vertical, namely, multiple-point, single-point, and integration. These three principal multiple-point methods in general use are the vertical velocity-curve, three-point and two-point method.

Vertical Velocity-Curve Method of Determining Mean Velocity.—In this method the centre of the meter is held as close to the surface of the water as possible, being careful to keep it out of reach of all surface disturbances, and then at a number of different depths throughout the vertical. The velocity at each position of the meter is recorded. These observations are then plotted with velocities in feet per second as abscissae and their corresponding depths in feet as ordinates, and a mean curve is drawn through the points. The mean velocity for the vertical is obtained by dividing the area bounded by the curve and its axis by the depth. In the absence of a planimeter for measuring the area, the depth is divided into five to ten equal parts, and the velocities of the centre ordinates of these parts are noted. The mean of these velocities will very closely approximate the mean in the vertical.

It is often more convenient, when the depth is a number of feet and a fraction, as 7.4, to divide the depth into seven parts of a foot width, and a part of 0.4 foot width. Then the velocity to enter for the narrow part is 0.4 of the velocity at the centre of it.

The vertical velocity curve is useful in studying the manner in which velocities occur in a vertical. From a study of a number of these curves the other shorter methods of determining mean velocity are deduced. On account of the length of time taken to complete a measurement, this method is not used in general routine measurements, except during the winter, for a change of stage is almost sure to occur during a measurement on a large stream which counterbalances the increased accuracy. For this reason its use is limited to the determination of the coefficient to be used in the reduction of values obtained by other methods of measuring velocity to the true value, to the measurements of velocities under new and unusual conditions of flow, and for measurements under ice.

Three-Point Method of Determining Mean Velocity.—This method is one of the short methods of obtaining the mean velocity in the vertical and, under some conditions, gives the most accurate results next to the vertical velocity-curve method. It has been used almost exclusively by this survey in past years, during the open water period, but recently has been superseded by the two-point method which, under most conditions, gives more accurate results. In the three-point method, the current-meter is held at 0.2, 0.6 and 0.8 depth. The mean is then obtained by dividing by four the sum of the velocities at 0.2 and 0.8 depth plus twice the velocity at 0.6 depth.

Two-Point Method of Determining Mean Velocity.—In studying the vertical curves made at a number of different points and under varied conditions, it has been found that the mean of the velocities occurring at 0.2 and 0.8 depth gives very nearly the mean velocity in the vertical. Use is made of this fact in the two-point method of determining mean velocity, the meter being held at 0.2 and 0.8 depth in the vertical. This method has been found more accurate than the single-point method and the time required for a metering is not very much greater. This method has been found to give, also, a very close approximate to the mean velocity in measurements of ice-covered streams, although these flow under very different conditions from those of open waters.

Single-Point Method of Determining Mean Velocity.—Experiments made under most favourable conditions and extending over a long period have established the point of mean velocity in a vertical at 0.6 of the depth. Therefore the error resulting from the use of the 0.6 depth as the depth of mean velocity is very small, though in some few cases a study of the vertical velocity curve will show the need of a coefficient to reduce the observed velocities to the mean. The variation of the coefficient from unity in individual cases is, however, greater than in the two or three-point method, and the general results are not as satisfactory. For that reason this method is not employed very extensively by the survey.

In the other principal single-point method the meter is held near the surface, at from 0.5 to 1 foot below the surface, care being taken to sink the instrument below the influence of wind or waves. The resulting velocities must be multiplied by a coefficient to reduce them to mean velocities. This coefficient as found by a large number of experiments, varies from 0.78 to 0.98, depending upon the depth and speed of the stream. The deeper the stream and the greater the velocity, the larger the coefficient. In flood work coefficients varying from 0.90 to 0.95 should be used. This method is only used when the current is too strong to permit the sinking of the meter to any great depth below the surface of the water. It is often employed at time of flood, or when a stream is carrying a lot of drift-wood or ice.

Integration Method of Determining Mean Velocity.—This method of determining the mean velocity in a vertical consists in moving the meter at a slow uniform speed from the bed of the stream to the surface and return in a vertical direction, the time and revolutions being observed. In travelling through all parts of the vertical the meter is acted upon by each and every thread of velocity from the bed to the surface of the stream, and the resulting observations determine the mean in that vertical.

This method is very useful in checking the results of other methods. It is, however, seldom, used by this survey, as the Price meter is not suited to observations by this method, since the vertical motion of the meter causes the wheel to revolve.

GAUGING STATIONS

The first step is to select a suitable locality for a gauging station. Although apparently simple, this is really a difficult task. Not only must the water be moving in nearly straight lines over a solid bed and between well defined banks, but the place must be accessible at moderate cost and there must be living near it a competent person who can be engaged to serve as observer. Permanent gauging stations should only be selected after a very thorough reconnaissance. In the irrigation districts and in more thickly populated districts there is more or less diversion of water. This is apt to complicate matters for the engineer, for a gauging station above all works may not include all the tributaries of the stream and it is often necessary to establish gauging stations at several points along the streams, and on tributaries, canals, and pipe lines in order to obtain complete information regarding the water supply in a particular stream.

There are three classes of gauging stations, namely, wading, bridge and cable stations. The wading station can of course only be used in the case of small streams having a maximum depth at its highest stage of three feet or less. The equipment for a wading station is small, consisting usually of a plain staff gauge, graduated to feet and hundredths, and fixed vertically to one of the banks of the stream. For convenience a measuring line, usually a wire with tags, may be fixed permanently at this section. When taking the reading, the engineer should stand below and to one side of the meter so as not to cause eddies in the water.

Bridge stations, because of their permanency, and the freedom of movement allowed the engineer, are much preferred. Very often, however, more particularly in swift currents, the piers materially affect the accuracy of the results. When the gauge cannot be attached to a pier it is often attached horizontally to the guard-rail or floor of the bridge, and the height of the stream is found by lowering a weight by a chain over a pulley. It is indicated by a marker on the chain. Distances of three, five or ten feet, according to the size of the stream, are marked on the lower chord of the downstream side of the bridge, to serve as a measuring line.

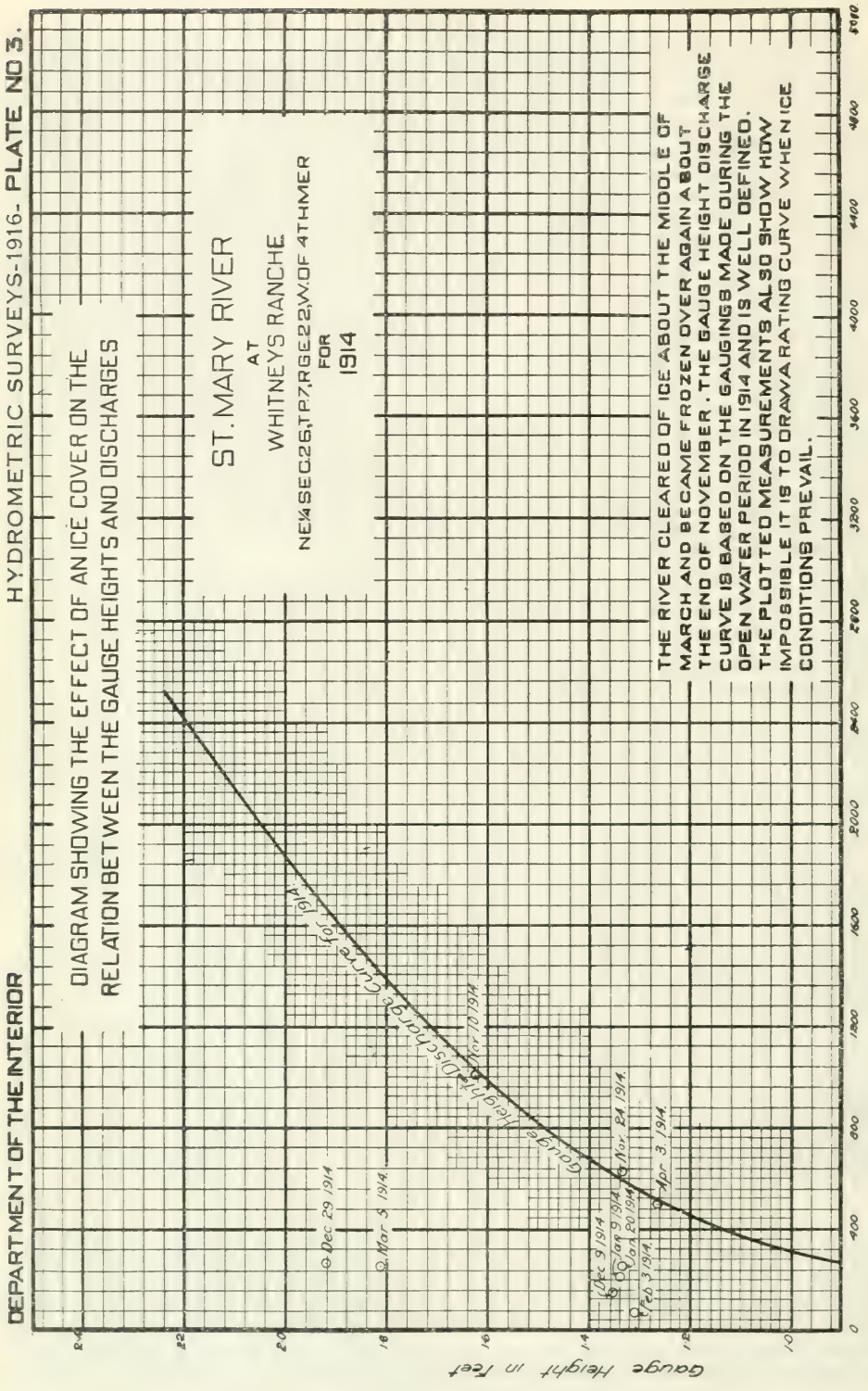
Frequently it is impossible to establish a permanent gauging station at a bridge. In that case the wire cable of a ferry can be utilized, or, if that is not available, a permanent wire cable is stretched across the river. For spans of average length a galvanized wire cable three-fourths of an inch in diameter is safe. It is supported at each bank by means of high struts or by passing it through the crotch of a tree. The cable is run into the ground and anchored securely to a "dead man" buried at least six feet below the surface, or, if convenient, it is anchored to a lower part of the trunk of a tree. A turnbuckle is inserted in the cable between the strut and anchorage to permit tightening the cable. A permanent measuring line, usually a wire, with tags five or ten feet apart, is stretched across the stream just above the cable. A cage large enough to carry two men and instruments is constructed and suspended from the cable by means of cast iron pulleys. The cage is moved from point to point by hand. A stay line, usually quarter-inch guy wire, is stretched across the stream about thirty to forty feet up stream from the cable, and securely fastened. By passing a sash cord through a pulley hung on this stay line the current-meter is prevented from being carried down stream. This type of station has the advantage that it can usually be located at the most desirable point on the stream and is free of piers and other obstructions.

LOW VELOCITY LIMITATIONS

Owing to the presence of a slight amount of friction in the current-meter, a certain definite velocity is required to make the wheel revolve, *i.e.*, to overcome the frictional resistence of the wheel. For this reason the meter is unsuitable for the measurement of low velocities approaching this value. This velocity, which is required to overcome friction, and which is obtained from the meter rating curve, is called the velocity of no flow for the particular meter referred to. It varies in different types of meters, and also slightly in meters of the same type, according to the time the meter is in use, but very seldom exceeds 0.2 foot per second in any meter. From a number of observations the low velocity limit, below which values of velocity are unreliable, is found to be 0.5 foot per second. In many cases at low stages the gauging station on a stream becomes unsuitable for a discharge measurement owing to the mean velocity in the section falling below the safe limit. In such instances, where it is possible to wade the stream, a suitable gauging section may be located within a reasonable distance of the regular station and the discharge measurements made at this point. When a gauging is made at a cross-section other than the regular station, sufficient soundings should be made at the latter at the time of the gauging to develop the cross-section and compute the area. The measurement is thus referred to the regular gauging station, and the mean velocity and area at the regular section are reported and used in the office computations.

OFFICE COMPUTATIONS

Rating Curves and Tables.—When a series of discharge measurements has been made at a gauging station a rating curve is constructed for that station, showing graphically the discharge corresponding to any stage of the stream within the limits covered by the gaugings. This curve, as it is usually drawn, has as abscissae the discharges in second-feet, and as ordinates the corresponding gauge heights at which the discharges were made. A smooth curve is drawn through the resulting set of points, and from this curve the discharges at any stage within the limits of the curve are taken. Some measurements may be more reliable than others, owing to more or less favourable conditions at different times of gauging, or to other causes. In order to obtain the weight of the different measurements, curves with area and mean velocity, as


DEPARTMENT OF THE INTERIOR
HYDROMETRIC SURVEYS-1916- PLATE NO 3.
DIAGRAM SHOWING THE EFFECT OF AN ICE COVER ON THE RELATION BETWEEN THE GAUGE HEIGHTS AND DISCHARGES
ST. MARY RIVER
AT
WHITNEYS RANCHE
NE¼SEC26,TP7,RGE22,W.OF 4THMER
FOR
1914
THE RIVER CLEARED OF ICE ABOUT THE MIDDLE OF MARCH AND BECAME FROZEN OVER AGAIN ABOUT THE END OF NOVEMBER. THE GAUGE HEIGHT DISCHARGE CURVE IS BASED ON THE GAUGINGS MADE DURING THE OPEN WATER PERIOD IN 1914 AND IS WELL DEFINED. THE PLOTTED MEASUREMENTS ALSO SHOW HOW IMPOSSIBLE IT IS TO DRAW A RATING CURVE WHEN ICE CONDITIONS PREVAIL.
Gauge Height in Feet
Discharge in Second Feet.
Dec 29 1914
Mar 5 1914
Dec 9 1914
Jan 9 1914
Jan 20 1914
Nov 24 1914
Feb 3 1914
Apr 3 1914
Gauge Height Discharge Curve for 1914

abscissae, and gauge heights as ordinates, are also drawn. From a study of these curves any discrepancies in a measurement, either in its area or mean velocity, may be detected. Should it be necessary to extend the rating curve beyond the limits of actual discharge measurements, the area and mean velocity curves may be constructed to the stages for which the discharge curve is desired, and the latter found by taking the product of the two curves. The discharge curve under natural conditions of flow is always convex to the gauge height axis. The area curve is either a straight line or is convex to the gauge height axis, except in the case of overhanging banks, when it becomes concave to the axis. The mean velocity curve is always concave to the gauge height axis, except in cases where standing water occurs below the stage of no-flow. In this case the curve will assume a reverse form, starting from the gauge height of zero-flow with a curve convex to the gauge height axis and gradually reversing to a curve concave to this axis. In plotting all three curves, the horizontal and vertical scales should be chosen that the curves may be used within the limits of accuracy for the work, and in their critical position will make, as nearly as possible, angles of 45 degrees with each axis.

The rating curve being constructed, it becomes necessary to prepare a station *rating table*, giving the discharge at any stage of the stream within the limits of the daily gauge height observations on record. From this rating table the daily discharges corresponding to the daily gauge heights are read and tabulated. The rating table is constructed for tenths, half-tenths, or hundredths of feet, according to the readings of the gauge to which it is to be applied. The discharges for this table are read directly from the rating curve and are then adjusted so that the differences for successive stages shall be either constant or gradually increasing, but never decreasing, unless the station is affected by backwater.

Daily Discharge, Monthly Mean, and Run-Off.—The rating table being made to cover the range of daily gauge height observations, the next procedure in the computations is to make out a table of daily discharges from this rating table. The daily gauge heights are copied as they were sent in by the observer, and opposite each the corresponding discharge is filled in from the rating table. The monthly discharge is found by totalling the daily discharges for the month in question, and the monthly mean is obtained by dividing this total by the number of days in the month.

The run-off is computed with two different sets of units, depending upon the kind of work for which the data are intended, as follows:

(1) Run-off in inches is the depth to which a plane surface equal in extent to the drainage area would be covered if all the water flowing from it in a given time were conserved and uniformly distributed thereon; it is used for comparing run-off with rainfall, which is usually expressed in depth in inches. The monthly mean run-off in second-feet is divided by the area of the drainage basin in square miles to find the monthly mean run-off per square mile. This result, reduced to run-off in depth in inches for the monthly period, is in the form required.

(2) The run-off in acre-feet is the form of most use in connection with storage. An acre-foot is equivalent to 43,560 cubic feet, and is the quantity of water required to cover an acre to the depth of one foot. The monthly mean run-off in second-feet is used for the computation of run-off in acre-feet. The monthly mean is reduced to cubic feet per month, and this quantity divided by 43,560 gives the run-off in acre-feet.

The run-off of the stream being computed both in depth in inches and in acre-feet for each month, the run-off for the period during which observations of run-off were made is found by the summation of the amounts of run-off for the several months making up this period.

Changing Conditions of Channel.—On streams such as Milk river, whose bed is in a constant state of motion, measurements of discharge should be made every few days, otherwise considerable data relating to changes cannot be obtained. For discharges on days other than those on which measurements are taken, the interpolation method is used. The two methods of interpolation in general use are the Stout and Bolster methods.

The Stout method deals with the correction of the gauge heights. A curve is drawn, using the difference between the actual gauge heights at the time of measurement and the gauge height corresponding to the measured discharge as ordinates, and the corresponding days of the month as abscissae. From an irregular curve drawn through these points corrections for gauge heights can be made for days on which there was no discharge measurement. When the discharge is greater than that given by the curve the correction is positive, and vice-versa. Each daily gauge height is corrected by the amount shown on the correction curve, and the corresponding discharge taken from an approximate rating curve for the station.

The Bolster method deals more particularly with the modification of the discharge. Results of discharge measurements covering a whole year or season are plotted and, though considerably scattered, will define one or more regular curves, called standard curves, the number and position of each indicating the radical changes. Where the river bed changes from day to day, the position of the standard curve also varies and must pass through the points indicating the different days. The points indicating two successive measurements are joined by a line, which for short distances on the cross-section paper is a straight line, and otherwise a curve. This line is divided into a number of equal parts, each indicating an intervening day, the assumption being that as the change during this period is gradual the daily rating must pass through each point or day, as represented by the divisions. A simple and convenient way of making these interpolations and moving the daily rating curve is to make a tracing of the standard curve with a vertical line of reference. By keeping the lines of reference coincident, this curve can be shifted into any desired position and the discharge read for any gauge height.

OBSERVATIONS OF GAUGE HEIGHTS ON ST MARY RIVER AT WHITNEY'S RANCH WITH CORRESPONDING MAXIMUM AND MINIMUM TEMPERATURES AND THE ESTIMATED DAILY DISCHARGES FOR THE WINTER 1913-1914.

The circles on the discharge graph indicate actual discharge measurements

WINTER RECORDS

Formation of Ice and Ice Conditions.—Perhaps the greatest difficulties in stream measurements are met with in the early part of the winter, just as the streams are commencing to freeze up. Especially is this true in the swift-running streams in or near the mountains. Needle and anchor ice often form in large quantities in rapids, and, flowing in masses with the water, make gaugings very difficult and unreliable. Even after a permanent ice cover is obtained at the gauging station this ice will, in some cases, obstruct the channel below the station and cause "backwater."

A further difficulty is that the surface ice usually forms along the edges of the stream for some time before forming in the centre of the channel. At first this may be broken away if the stream is small and open water measurement made, but later it is necessary to take some observations through holes in the ice along the edge. As the streams get farther away from the mountains their velocity decreases, and fewer rapids occur along their course. There is then less trouble with needle and anchor ice, and a permanent ice cover forms much more quickly.

In many cases the section used during the summer is very unsuitable for making measurements during the winter. It may be (a) too wide and shallow or flowing in two channels during the winter, due to low water; (b) partially open, due to swift running water or warm water running in; (c) affected by needle and anchor ice, either by flowing in the water, or causing backwater; (d) located where the snow drifts over the ice to a great depth; (e) that it is likely to have a rough ice cover or pile up with ice, due to swift water and a rough bed, (f) that there is a tendency for ice jambs to occur, with consequent backwater, etc.

It is therefore often necessary to choose a new section for winter observations. This should be done before freeze-up, for then the width, depth, uniformity of flow and conditions above and below can be easily noted. The most suitable stations for winter measurements are those which have a long stretch of very smooth, sluggish water above, and a rapid fall below.

Discharge Measurements.—In winter as in summer, the daily discharges of a stream are computed from frequent discharge measurements, and daily gauge height observations. The discharge measurements are made through holes in the ice from five to ten or even twenty feet apart, depending upon the size of the stream, and large enough to allow the current-meter to pass through freely. The gaugings are made in the same manner as at open sections except that the depth of the stream is taken as the distance from the bottom of the ice to the bed of the stream. The soundings, however, are always referred to the surface of the water in the holes, the distance from the surface of the water to the bottom of the ice being measured and subtracted from the soundings to obtain the depth.

The vertical velocity curve method is usually used for the determination of the mean velocity in the vertical. A curve is plotted for each vertical, and the mean velocity is determined in the usual manner. These curves vary greatly as to form for different kinds and conditions of channel.

The typical curve, however, differs from that obtained from an open water observation in that it is drawn back more at the surface, owing no doubt to greater friction between the ice and the water as compared with the water and the atmosphere. As a result there are two points in the vertical at which the thread of mean velocity occurs under an ice cover. These points are near 0.2 and 0.8 of the total depth below the bottom of the ice, and the mean of the velocities at these two depths will give accurate results, but when close estimates of the discharges are required, and the conditions are not very favourable, the vertical velocity method should be used.

It is found that when all the holes are opened on a small swift stream, there are sometimes vertical pulsations of the water in the holes, which affect the velocity readings. This can usually be avoided by only opening one hole at a time, and filling it in again with ice and snow as soon as the observation is finished. It can also be overcome by inserting a thin sheet of galvanized tin or iron at the bottom of the hole after the meter has been lowered into the water. The meter should always be held near the upstream side of the hole.

In using the meter care must be taken to keep it under the water as much as possible to prevent ice from forming around the bearings. It is a good plan to clean and oil the meter indoors before starting out to make a gauging.

Gauges and Gauge Observations.—The gauge is usually read once each day, the observer noting the elevation of the water as it rises in a hole cut through the ice, the height of the top of the ice, the thickness of the ice, presence of needle or slush ice, snow on top of ice, ice jams, and any sudden changes in temperature. To do this the observers are provided with an ice chisel for chopping holes, and an L-shaped ice scale to measure the thickness of the ice.

A difficulty which arises in obtaining the thickness of the ice is that in a hole kept open for some time the ice wears away around the bottom of the hole, and may make it necessary to cut a new hole near by, or to enlarge the original.

Any form of gauge may be used, but the chain gauge is the most satisfactory, as the staff gauge, being frozen to the ice, heaves with it, and also in cutting away the ice from around it the figures are effaced. The automatic gauge gives trouble with the well freezing over.

Estimates of Daily Discharge.—While the run-off, particularly during the winter months, does not vary directly in accordance with the precipitation, the rate at which it reaches the

streams is, of course, dependent almost entirely upon the climatic conditions. The climate in the mountains is subject to great extremes, but during the winter almost the entire precipitation is in the form of snow.

There is, therefore, very little surface run-off, and the flow of the streams comes almost entirely from the glaciers, ground waters and lake storage, and except for the losses due to freezing and the slight increases, due to the melting of snow and ice by chinooks (warm winds), the flow in the streams would remain constant or would change gradually.

There are, however, certain local conditions in Western Canada which make it exceptionally difficult to make estimates of the daily discharge during the winter. The gauge height in many cases fluctuates very much, and often sudden rises or drops occur. These rises are often explained by the fact that during very cold spells a great deal of slush, frazil, and anchor ice is formed and chokes up the channel, thus raising the surface of the water, when in reality the discharge is decreasing. Then, again, a chinook causes a sudden rise in temperature and the discharge is often increased, while at the same time the gauge height gradually lowers, evidently because the warmer weather and water have melted out a lot of the ice from the channel and given it a greater carrying capacity.

In order to make reliable estimates of the daily discharge, gaugings must be made at short intervals and the weather conditions and temperatures in the whole of the drainage area above the stations must be very carefully studied.

W. G. Hoyt, District Engineer, Water Resources Branch, U.S. Geological Survey, has made an exhaustive study of methods for estimating the flow when streams are frozen. The various methods described by him in an article in "Engineering News" on April 10, 1913, and Water-supply Paper 337, published by the United States Geological Survey in 1913, and modifications of them, are used. The graphic method of interpolation has been found to be generally applicable, but as the precipitation during the winter months has so little effect upon the run-off during that period, it is seldom plotted on the sheets. It is also considered that the extremes and ranges of temperatures are better guides for interpolation than the mean temperatures, and the minimum and maximum temperatures are both plotted and given due consideration rather than the mean temperatures.

The weather conditions and temperatures at the gauging station are not always typical for the whole drainage basin above, and care must therefore be taken to have the meteorological observations made at some other place, or, if necessary, at two or more places. Of course, care must be taken to study all the possible conditions which may affect the estimates.

Plate 4 shows typical conditions and illustrates the graphic method of interpolating the daily discharges.

Additional information on this subject may be found in the appendix of the 1914 report.

RATING CURRENT-METERS

Each meter is rated before being used, in order to determine the relation between the revolutions of the wheel and the velocity of the water. The meter is driven at a uniform rate of speed through still water for a given distance, and the number of revolutions of the wheel and the time are recorded. From this data the number of revolutions per second and the corresponding velocity per second are computed. Tests are made for speeds varying from the slowest which will cause the wheel to revolve to several feet per second. The results of these runs, when plotted, with revolutions per second as abscissae, and velocity in feet per second as ordinates, locate points that define the meter rating-curve, which for all meters is practically a straight line. From this curve a meter rating table is prepared. Theoretically, the rating for all meters of the same make and type should be the same, but as the result of slight variations in construction and in the bearing of the wheel on the axis at different velocities, the ratings differ.

After a meter has been in use for some time the cups may have received small injuries, or the bearing of the wheel on the axis may have changed owing to unavoidable rough usage. These changes will affect the running of the meter and change its ratings. As a consequence, each meter is re-rated at regular intervals and a new rating curve and table prepared.

Descriptions of the rating station, discussions of the methods employed, and the results of ratings, are given in the Reports of Progress of Stream Measurements for the years 1911 and 1912.

PEACE RIVER DRAINAGE BASIN

General Description

Peace river is the largest and longest tributary of the McKenzie river. It is formed by the confluence of the Finlay and Parsnip rivers, both of which rise in and drain a large district lying along the eastern slope of the Rocky mountains in northern British Columbia.

From its head the Peace flows in a general easterly direction, through a large plateau, some 300 miles, to the mouth of the Smoky river, its largest and most important tributary. Between these two points there are a few small streams entering the Peace river, the most notable being the Pine river, which rises in the hills in British Columbia near the Alberta boundary.

From the mouth of the Smoky, the river flows north for about 250 miles, nearly to Fort Vermilion, then pursues a northeasterly course for about 200 miles, where it is joined by the overflow from lake Athabaska, forming the Slave river. The territory drained by this portion of the Peace river is bounded on the north by the Laird river, and on the south and east by the Fraser and Athabaska rivers. Of several streams discharging their waters into the Peace river between the mouth of the Smoky and lake Athabaska there are only two that drain a very large area. These are the Wabiskaw and Red rivers, both of which rise on the height of land west of the Athabaska and drain a large low country lying between the Peace and Athabaska rivers, and north of the Lesser Slave lake.

Aside from these two rivers and the Smoky which receives a small portion of its supply from a thinly wooded and prairie country, the Peace has no important tributaries which cannot be considered as mountain streams. Therefore the stage of water is governed to a large extent by storage of winter precipitation in the mountains, and floods in the early spring are not usual. However, in July and August, high temperatures and warm rains in the mountains cause the snow-covered portion of the drainage basin to discharge large quantities of water, and it is at this time that the greatest floods occur.

In 1916, there were no excessive floods on the Peace river; the maximum stage was reached at the town of Peace River on July 6, and was the result of the usual high summer temperatures in the mountains and foot-hills during the latter part of the month of June.

As yet little hydrometric work has been done in the basin of the Peace river, the country being very sparsely settled, and means of transportation are few and costly, but as these improve, more information will become available.

SMOKY RIVER AT PRUDENT'S CROSSING

Location.—On the SW.¼ Sec. 10, Tp. 78, Rge. 24, W. 5th Mer., at the ferry crossing between Prudent's crossing and F. D. McArthur's cache No. 19, until June 15, 1916, when, owing to the Provincial Government removing their ferry, a new station was established on the SW. ¼ Sec. 2, Tp. 78, Rge. 24, W. 5th Mer., two miles up stream from the ferry, and directly under the E.D. & B.C. Railway Company's bridge.

Records available.—June 2, 1915, to December 31, 1916.

Gauge.—Vertical staff on left bank of river about 200 feet up stream from Ferry tower; elevation of zero maintained at 80.50 from June 2, 1915, to June 14, 1916.

Chain gauge on downstream side of downstream guard rail 63.6 feet from west end of bridge. Elevation of zero 77.45 feet maintained from June 15, to November 15, 1916.

Bench marks.—Spike driven in poplar stump, on left bank of river near ferry and about 150 feet up stream from staff gauge. Assumed elevation 105.14 feet.

Secondary bench-mark, drift bolt northwest abutment of E.D. & B.C. Railway Company's bridge; assumed elevation 100.00 feet.

Channel.—At ferry, one channel at all stages, shifting conditions.

At bridge, one channel, shifting conditions.

Discharge measurements.—Made from ferry boat and bridge.

Winter flow.—River affected by ice from November to April.

Observers.—A. Rainville, January 1 to May 31, 1916. L. C. Vogel, from June 16 to December 31, 1916.

Discharge Measurements of Smoky river at Prudent's Crossing, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 6	C. M. O'Neil	850	3,316	0.34	8.21	1,111
Feb. 1	do	857	3,109	0.36	7.95	1,114
Feb. 27	do	862	3,603	0.53	8.85	1,925
Mar. 23	do	861	3,597	0.45	8.70	1,612
April 20	do	880	5,625	1.54	9.10	8,633*
May 17	H. S. Kerby	631	3,844	2.27	9.84	8,714
June 15	P. H. Daniells	864	4,605	4.42	4.95	20,366
July 1-2	do	877	5,616	4.51	5.50	25,342
July 19	do	927	7,173	3.84	5.92	27,538
Aug. 5	do	922	5,552	2.60	4.11	14,416
Oct. 26	C. McGavin	899	4,182	1.82	2.75	7,635
Nov. 11	do	689	3,671	1.40	1.69	5,140*e*
Dec. 8	do	470	2,912	0.71	3.03	2,069

* Slope measurement.
e Estimated discharge.

Daily Gauge Height and Discharge of Smoky river at Prudent's Crossing, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-Ft.*	*Feet*	*Sec.-Ft.*	*Feet*	*Sec.-Ft.*	*Feet*	*Sec.-Ft.*	*Feet*	*Sec.-Ft.*	*Feet*	*Sec.-Ft.*
1	8.60*b*	1,230	7.94	1,110	8.57	1,820	8 70	2,850	12.30	20,270	11.90	17,870
2	8.60	1,190	7.94	1,120	8.47	1,800	8.70	3,400	12.90	24,110	12.54	21,746
3	8.50	1,170	7.84	1,160	8.47	1,770	8.70	3,760	12.90	24,110	12.66	22,520
4	8.50	1,140	7.84	1,200	8.47	1,760	8.90	3,910	12.90	24,110	12.82	23,574
5	8.50	1,130	7.84	1,250	8.37	1,700	9.00	4,150	13.00	24,790	13.44	27,888
6	8.39	1,110	7.84	1,300	8.37	1,680	9.39*a*	4,750	14.00	31,920	12.46	21,242
7	8.39	1,115	7.84	1,350	8.37	1,670	9.78*a*	5,850	13.75*a*	30,120	11.92	17,990
8	8.39	1,120	7.84	1,400	8.36	1,640	10.18*a*	6,900	13.53	28,536	11.42	15,302
9	8.39	1,125	7.85	1,460	8.26	1,600	10.58*a*	8,300	12.59	22,066	11.20*a*	14,200
10	8.29	1,130	7.75	1,510	8.16	1,560	10.98*a*	9,100	11.54	15,918	11.40*a*	15,200
11	8.29	1,140	7.75	1,550	8.16	1,530	11.38	10,120	10.79	12,307	11.60*a*	16,230
12	8.28	1,150	7.75	1,610	8.16	1,500	10.85*a*	8,800	10.33	10,434	11.80*a*	17,300
13	8.28	1,190	7.95	1,680	8.16	1,480	10.32*a*	8,550	10.14*a*	9,712	11.80*a*	17,300
14	8.28	1,230	7.95	1,740	8.16	1,450	9.79	8,400	9.95	9,030	12.00*a*	18,470
15	8.38	1,300	7.85	1,800	8.15	1,440	9.73*a*	8,200	9.92*a*	8,928	5.00	20,750*x*
16	8.38	1,380	7.85	1,870	8.05	1,450	9.67*a*	8,050	9.90*a*	8,860	6.98	35,600
17	8.37	1,415	7.86	1,950	8.05	1,470	9.61*a*	7,940	9.88	8,798	7.07	36,275
18	8.17	1,420	7.86	2,010	8.05	1,490	9.55*ab*	7,880	9.80	8,550	7.71	41,075
19	8 07	1,400	7.86	2,060	8.05	1,520	9.48	7,690	10.10	9,560	7.42	38,900
20	8.17	1,360	7.90	2,110	8.05	1,580	9.10	6,770	11.00	13,250	8.02	43,402
21	8.17	1,300	8.16	2,120	8.05	1,600	8.90	6,320	11.40	15,200	9.22	52,522
22	8.16	1,200	8.46	2,130	8.64	1,610	8.90	6,320	11.40	15,200	8.39	46,214
23	8.16	1,090	8.66	2,120	8.70	1,610	8.80	6,120	11.00	13,250	7.59	40,175
24	8.16	1,050	8.72	2,080	8.70	2,000	8.70	5,930	10.90	12,790	6.86	34,700
25	8.16	1,040	8.78	2,000	9.00	2,400	8.50	5,560	10.50	11,100	6.76	33,950
26	8.15	1,030	8.85	1,980	9.00	2,640	8.40	5,380	10.50	11,100	6.43	31,475
27	8.05	1,030	8.81	1,925	9.00	2,730	8.50	5,560	10.50	11,100	6.23	29,975
28	8.05	1,030	8.78	1,890	9.00	2,790	8.80	6,120	10.50	11,100	6.00	28,250
29	8.05	1,040	8.75	1,830	9.00	2,800	9.90	8,860	10.70	11,920	5.70	26,000
30	8.05	1,060	.....	.....	9.00	2,750	11.80	17,300	10.90	12,790	5.57	25,025
31	7.94	1,100	.....	.....	8.80	2,730	.....	.....	11.50	15,710	.....	.....

a Gauge height interpolated.
b Ice conditions, January 1 to April 18.
x New gauge, June 15.

DAILY GAUGE HEIGHT AND DISCHARGE of Smoky river at Prudent's Crossing, for 1916
—*Concluded*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	5.40	23,750	5.10	21,500	3.40	10,500	2.09*a*	5,858	2.25	6,250	3.10	2,810
2	5.40	23,750	4.90	20,000	3.60	11,450	2.06*a*	5,792	2.21	6,146	3.06	2,670
3	4.70	18,510	4.87	19,775	3.70	11,970	2.03	5,726	2.11	5,904	3.06	2,550
4	4.80	19,250	4.80	19,250	3.90	13,100	2.01	5,682	2.15	6,000	3.06	2,460
5	15.20	98,000	4.10	14,340	3.90	13,100	1.99	5,640	2.11	5,904	3.04	2,410
6	11.40	69,120	3.95*a*	13,405	3.80	12,520	1.95	5,560	2.01	5,682	3.06	2,380
7	9.70	56,170	3.80	12,520	3.60	11,450	2.02	5,704	2.01	5,682	3.04	2,220
8	8.11	44,086	3.70	11,970	3.40	10,500	2.06	5,792	1.97	5,600	3.05	2,080
9	8.40	46,290	3.70	11,970	3.30	10,050	2.08	5,832	1.86	5,388	3.05	2,050
10	8.60	47,810	3.80	12,520	3.30	10,050	2.04	5,748	1.75	5,195	3.00	1,990
11	8.80	49,330	3.90	13,100	3.10	9,180	2.04	5,748	1.69	5,094	2.90	1,880
12	7.90	42,500	3.50	10,960	3.10	9,180	2.01	5,682	1.63	4,998	2.80	1,810
13	7.20	37,250	3.60	11,450	3.00	8,760	2.01	5,682	1.58	4,920	2.70	1,750
14	6.90	35,000	3.50	10,960	2.90	8,360	3.10	9,180	1.43	4,709	2.70	1,750
15	6.70	33,500	3.40	10,500	2.80	7,980	4.16	14,730	3.45*b*	4,650	2.80	1,760
16	5.90	27,500	3.20	9,610	2.60	7,280	4.56	17,492	3.47	4,640	2.80	1,820
17	5.20	22,250	3.30	10,050	2.56*a*	7,152	4.16	14,730	3.29	4,600	2.90	1,890
18	5.40	23,750	3.40	10,500	2.52*a*	7,024	3.76	12,300	3.22	4,500	3.00	1,940
19	5.90	27,500	3.20	9,610	2.48*a*	6,900	3.26	9,874	3.24	4,050	3.00	1,990
20	5.93	27,725	3.25	9,830	2.44*a*	6,780	2.96	8,600	3.23	3,800	2.90	1,970
21	5.40	23,750	3.30	10,050	2.40*a*	6,660	2.46	6,840	3.80	3,700	2.90	1,880
22	5.40	23,750	3.20	9,610	2.36*a*	6,558	2.36	6,558	3.83	3,700	2.94	1,920
23	5.10	21,500	3.10	9,180	2.32*a*	6,436	2.56	7,152	3.77	3,690	2.94	1,930
24	5.00	20,750	3.10	9,180	2.28*a*	6,328	2.46	6,840	3.70	3,860	2.90	1,890
25	4.90	20,000	3.00	8,760	2.24*a*	6,224	2.76	7,836	3.66	3,830	2.88	1,900
26	4.90	20,000	3.10	9,180	2.20*a*	6,120	2.76	7,836	3.52	3,720	2.84	1,890
27	5.10	21,500	3.50	10,960	2.16*a*	6,024	2.71	7,656	3.32	3,590	2.82	1,820
28	5.20	22,250	3.60	11,450	2.21*a*	6,146	2.70	7,620	3.20	3,490	2.80	1,900
29	5.30	23,000	3.50	10,960	2.18*a*	6,072	2.61	7,314	3.20	3,390	2.80	1,880
30	5.20	22,250	3.40	10,500	2.15*a*	6,000	2.51	6,992	3.18	3,240	2.80	1,840
31	5.10	21,500	3.40	10,500	.....	.....	2.41	6,690	.....	.....	2.80*b*	1,800

a Gauge height interpolated.
b Ice conditions from November 15 to December 31.

MONTHLY DISCHARGE of Smoky river at Prudent's Crossing, for 1916

(Drainage area 18,932 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square mile	Depth in inches on Drainage Area	Total in Acre-feet
January	1,420	1,030	1,175	0.062	0.07	72,239
February	2,130	1,110	1,701	0.090	0.10	97,842
March	2,800	1,440	1,857	0.098	0.11	114,183
April	17,300	2,850	6,961	0.368	0.41	414,208
May	31,920	8,550	15,698	0.829	0.96	965,232
June	52,522	14,200	27,704	1.463	1.63	1,648,503
July	98,000	18,510	32,687	1.727	1.99	2,009,858
August	21,500	8,760	12,070	0.637	0.73	742,160
September	13,100	6,000	8,528	0.450	0.50	507,416
October	17,492	5,560	7,764	0.410	0.47	477,393
November	6,250	3,240	4,664	0.246	0.27	277,508
December	2,810	1,750	2,027	0.107	0.12	124,637
The year	.....	.....	.....	.....	7.36	7,451,179

HARMON (NORTH HEART) RIVER AT PEACE RIVER

Location.—On the NW. ¼ Sec. 29, Tp. 83, Rge. 21, W. 5th Mer., about 200 feet above foot bridge located one-half mile above mouth of river and 1,500 feet above traffic bridge.

Records available.—May 31, 1915, to December 31, 1916.

Gauge.—Vertical staff; elevation of zero maintained at 88.10 feet from establishment to December 31, 1915; elevation of zero maintained at 86.71 feet during 1916.

Bench-mark.—Spike driven in fifteen-inch poplar tree eighty feet down stream from gauge; assumed elevation 100.00 feet.

Channel.—One channel at all stages, fairly permanent.

Discharge measurements.—Made from traffic bridge, during high water; by wading, during low water.

Winter flow.—River affected by ice from November to April.

Observer.—Ralph Harris.

DISCHARGE MEASUREMENTS of Harmon (North Heart) river at Peace River, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 4	C. M. O'Neil	15.0	8.26	0.80	2.17	6.6
Jan. 26	do	7.5	3.95	0.94	1.89	3.8
Feb. 23	do	28.0	26.60	0.26	2.19	7.0
Mar. 18	do	28.0	26.00	0.23	1.99	5.9
April 22	do	56.0	182.00	4.58	4.59	833.0
May 20	H. S. Kerby	58.0	138.00	3.46	2.59	477.0
June 20	P. H. Daniells	49.0	66.75	1.27	1.49	85.0
July 5	do	40.0	53.50	0.95	1.32	51.0
July 24	do	54.0	84.00	2.08	1.76	176.0
Aug. 11	do	39.0	51.40	1.23	1.30	63.0
Aug. 31	do	33.0	35.00	0.60	1.19	21.0
Oct. 12	C. McGavin	66.0	33.20	1.56	1.29	52.0
Nov. 1	do	33.0	34.65	1.09	1.39	38.0
Nov. 14	do	47.0	35.85	0.47	1.62	16.8
Dec. 15	do	54.0	12.14	0.17	2.26	2.0

DAILY GAUGE HEIGHT AND DISCHARGE of Harmon (North Heart) river at Peace River, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.32*b*	7.0	1.89	4.0	2.19	6.8	2.09	6.4	3.79	680	2.06	286
2	2.32	6.7	1.89	4.0	2.19	6.7	4.19	50.0	3.69	660	2.06	286
3	2.32	6.5	1.89	3.9	2.19	6.6	4.19	120.0	3.69	665	2.06	286
4	2.22	6.5	1.89	3.8	2.19	6.5	4.29	180.0	3.69	670	2.06	286
5	2.22	6.7	1.89	3.8	2.19	6.5	4.29	210.0	3.69	675	2.06	286
6	2.22	6.4	1.89	3.8	2.19	6.6	4.29	265.0	3.59	656	2.06	286
7	2.13	6.0	1.89	3.8	2.09	6.8	4.39	400.0	3.59	660	1.96	250
8	2.13	6.0	1.89	3.7	2.09	6.8	4.39*b*	480.0	3.39	615	1.96	250
9	2.14	6.0	1.90	3.4	2.09	6.7	3.39	518.0	3.39	619	1.96	250
10	2.04	5.9	1.80	3.3	2.09	6.6	3.39	518.0	3.38	623	1.96	250
11	2.04	5.8	1.80	4.0	2.09	6.3	4.19	715.0	3.28	602	1.95	246
12	2.05	5.7	1.80	5.4	2.09	6.1	4.29	739.0	3.18	582	1.95	246
13	2.05	5.7	3.20	7.4	1.99	5.8	4.29	739.0	3.18	587	1.95	246
14	2.06	5.7	3.20	9.5	1.99	5.7	4.49	788.0	3.08	567	1.85	210
15	2.06	6.0	3.20*a*	11.4	1.99	5.8	4.49	788.0	2.98	547	1.85	210
16	2.76	8.3	3.20*a*	13.0	1.99	5.8	4.49	788.0	2.88	530	1.75	174
17	2.57*a*	9.9	3.20*a*	13.8	1.99	5.9	4.29	739.0	2.88	534	1.65	138
18	2.37*a*	9.8	3.20*a*	13.8	1.99	5.9	4.29	739.0	2.68	489	1.65	138
19	2.18*a*	8.6	3.20*a*	13.3	1.99	6.0	4.39	764.0	2.68	494	1.65	138
20	2.08	7.2	3.30*a*	11.9	1.99	6.0	4.49	788.0	2.57	469*s*	1.64	134
21	2.08	6.0	3.20*a*	9.8	1.99	6.0	4.59	812.0	2.57	469	1.64	134
22	2.09	5.1	3.21	7.6	1.99	6.0	4.39	764.0	2.47	433	1.64	134
23	1.99	4.7	2.19	7.1	1.99	6.0	4.49	838.0*s*	2.37	397	1.64	134
24	1.99	4.6	2.19	7.1	1.99	6.0	4.49	842.0	2.37	397	1.54	104
25	2.00	4.0	2.19	7.2	1.99	6.0	4.29	774.0	2.27	361	1.54	104
26	1.89	3.8	2.19	7.2	1.99	6.0	4.19	754.0	2.27	361	1.54	104
27	1.89	3.8	2.19	7.2	1.99	6.0	3.99	710.0	2.27	361	1.54	104
28	1.89	3.9	2.19	7.2	1.99	6.0	3.99	715.0	2.17	325	1.54	104
29	1.89	3.9	2.19	7.0	1.99	6.0	3.79	670.0	2.17	325	1.54	104
30	1.89	4.0	.....	.....	1.99	6.0	3.79	675.0	2.17	325	1.54	104
31	1.89	4.0	.....	.....	1.99	6.0	.....	.....	2.12*a*	307	.....	.....

a Gauge height interpolated.
b Ice conditions January 1 to April 8.
s Shifting conditions April 23 to May 20.

DAILY GAUGE HEIGHT AND DISCHARGE of Harmon (North Heart) river at Peace River for 1916.
—*Concluded.*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1....	1.54	104	1.60	140	1.20	22	1.27	41	1.39	35.0	1.88	12.80
2....	1.64	134	1.60	142	1.20	22	1.27	42	1.39	35.0	1.88	13.00
3....	1.80	192	1.60	144	1.20	23	1.26	41	1.51*b*	37.0	1.88	12.70
4....	1.90	228	1.50	112	1.20	23	1.26	41	1.53	35.0	1.89	12.30
5....	2.00	264	1.50	115	1.20	24	1.26	42	1.65	33.0	1.49	8.20
6....	2.80	552	1.40	88	1.20	24	1.26	43	1.67	31.0	1.49	8.10
7....	2.90	588	1.40	85	1.20	25	1.26	44	1.68	29.0	1.99	8.20
8....	2.90	588	1.40	82	1.20	25	1.26	44	1.69	27.0	2.00	7.50
9....	2.90	588	1.40	78	1.19	25	1.26	45	1.70	25.0	2.00	6.00
10....	2.80	552	1.40	74	1.19	26	1.26	46	1.62	23.0	2.00	4.90
11....	2.40	408	1.40	70	1.19	27	1.26	47*s*	1.54	21.0	2.00	3.50
12....	2.20	336	1.40	66	1.19	27	1.25	46	1.56	19.3	2.00	2.80
13....	2.20	336	1.30	59	1.19	28	1.25	46	1.58	18.0	1.90*a*	2.50
14....	2.20	336	1.30	57	1.19	28	1.25	46	1.60	16.8	1.70*a*	2.20
15....	2.20	336	1.30	55	1.19	29	1.24	44	1.70	16.7	1.51*a*	2.00
16....	2.20	336	1.30	53	1.19	29	1.34	57	1.71	17.0	1.31	2.00
17....	2.20	336	1.20	42	1.18	29	1.34	57	1.71	17.3	1.21	1.90
18....	2.20	336	1.20	41	1.18	30	1.34	57	1.72	17.1	1.10	1.80
19....	2.10	310	1.10	31	1.19*a*	32	1.33	55	1.72	16.6	1.10	1.70
20....	2.10	310	1.10	30	1.20*a*	34	1.43	73	1.73	16.3	1.10	1.60
21....	2.00	264	1.10	28	1.21*a*	34	1.43	73	1.73	16.2	1.10	1.52
22....	1.90	228	1.00	20	1.22*a*	35	1.42	71	1.74	15.7	1.20	1.41
23....	1.80	192	1.00	19	1.23*a*	36	1.42	71	1.84	15.0	1.20	1.30
24....	1.80	192	0.90	13	1.24*a*	37	1.42	71	1.85	14.1	1.20	1.30
25....	1.80	194*s*	0.90	12	1.25*a*	38	1.42	71	1.85	13.7	1.20	1.22
26....	1.80	197	0.70	9	1.27	39	1.31	53	1.86	13.7	1.20	1.02
27....	1.70	165	0.60	7	1.27	39	1.21	41	1.86	13.0	1.20	1.01
28....	1.70	168	0.60	7	1.27	40	1.20*a*	40	1.87	12.5	1.20	0.82
29....	1.70	170	0.50	6	1.27	40	1.17*a*	37	1.87	12.7	1.20	0.70
30....	1.70	172	0.50	6	1.27	41	1.13*a*	34	1.87	13.2	1.20	0.70
31....	1.60	138	1.20	21	.....	.....	1.10*a*	31	.....	.....	1.20*b*	1.00

a Gauge height interpolated.
b Ice conditions November 3 to December 31.
s Shifting conditions July 25 to October 11.

MONTHLY DISCHARGE of Harmon (North Heart) river at Peace River, for 1916

(Drainage area 510 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	9.9	3.80	5.9	0.012	0.01	363
February	13.8	3.30	7.2	0.014	0.02	414
March	6.8	5.70	6.2	0.012	0.01	381
April	842.0	6.40	596.0	1.169	1.30	35,464
May	680.0	307.00	516.0	1.012	1.17	31,728
June	286.0	104.00	191.0	0.375	0.42	11,365
July	588.0	104.00	298.0	0.584	0.67	18,323
August	144.0	6.00	55.0	0.108	0.12	3,382
September	41.0	22.00	30.0	0.059	0.07	1,785
October	73.0	31.00	53.0	0.104	0.12	3,259
November	37.0	12.50	21.0	0.041	0.05	1,250
December	13.0	0.70	4.1	0.008	0.01	252
The year	.....	.....	.....	.....	3.97	107,966

PEACE RIVER AT PEACE RIVER

Location.—On the NE. ¼ Sec. 30, Tp. 83, Rge. 21, W. 5th Mer., about 1,200 feet below the mouth of the Harmon (North Heart) river, 300 feet north of Mr. H. White's house.

Records available.—May 28, 1915, to December 31, 1916.

Gauge.—Vertical staff, on left bank of river; elevation of zero maintained at 70.70 feet from May 28 to November 13, 1915; elevation of zero maintained at 68.82 feet from November 13, 1915, to December 31, 1916.

Bench-mark.—Spike driven in stump of poplar tree, on left bank of river about 200 feet upstream from gauge; assumed elevation 93.61 feet.

Channel.—One channel at all stages, fairly permanent.

Discharge measurements.—Made from ferry boat at ferry crossing, about 150 feet above mouth of Harmon (North Heart) river, or from small motor boat when ferry is not available.

Winter flow.—River affected by ice from November to May.

Observer.—Harry White.

Remarks.—It has not been possible to record the drainage area from maps available.

DISCHARGE MEASUREMENTS of Peace river at Peace River, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 2	C. M. O'Neil	1,122	12,517	0.84	4.12	10,483
Jan. 27	do	1,060	10,634	0.74	2.60	7,887
Feb. 24	do	1,122	11,067	1.01	4.12	11,214
Mar. 19-20	do	1,120	11,173	0 93	4.05	10,358
April 24	do	1,140	15,228	1.92	5.27	29,042*x*
May 21	H. S. Kerby	1,325	21,830	6.02	9.58	131,011
May 22	do	.....	23,930	6.42	10.70	153,630*x*
June 19	P. H. Daniells	1,592	33,600	6.34	14.44	213,024*x*
July 7	do	1,610	34,946	6.62	15.29	231,342*x*
July 10	do	1,590	32,805	6.13	14.39	200,095*x*
July 23	do	1,426	25,692	5.79	9.64	148,802
Aug. 12	do	1,316	19,796	4.05	6.44	80,222
Oct. 9	C. McGavin	.....	13,900	1.74	3.10	24,150*e*
Oct. 31	do	1,171	14,643	1.99	3.53	29,199
Nov. 16	do	.....	10,233	1.20	1.34	12,280*e*
Dec. 13-14	do	1,120	9,342	0.72	2.40	6,686

x Slope measurement.

e Estimated discharge, based on area and velocity.

NOTE.—Discharge measurements made above Harmon (North Heart) river, but records of daily and monthly discharge include flow of Harmon (North Heart) river.

DAILY GAUGE HEIGHT AND DISCHARGE of Peace river at Peace River, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.10*b*	10,397	3.83	7,954	4.40	11,897	4.00	10,446	7.34	90,844	10.57	150,045
2	4.12	10,490	3.85	8,004	4.36	11,297	4.00	10,650	7.74	97,922	10.72	152,820
3	4.09	10,547	3.87	8,034	4.37	10,867	4.20	10,910	8.30	108,080	10.36	146,160
4	4.06	10,517	3.89	8,074	4.23	10,456	4.30	11,290	8.90	119,150	10.41	147,085
5	4.03	10,367	3.90	8,084	4.19	10,206	4.60	11,850	11.66	170,210	12.16	179,460
6	4.01	10,296	3.91	8,114	4.15	9,907	4.70	12,545	12.26	181,310	13.00	195,000
7	3.94	10,006	3.92	8,114	4.11	9,697	4.80	13,230	12.07	177,795	12.40	183,900
8	3.96	9,746	3.94	8,094	4.01	9,507	5.20	13,900	11.67	170,395	11.45	166,325
9	3.94	9,456	3.96	8,093	3.97	9,387	5.15*a*	14,328	11.48	166,880	10.79	154,115
10	3.91	9,286	3.82	8,113	3.94	9,287	5.05	14,698	8.93	119,705	10.19	143,015
11	3.89	9,136	3.78	8,124	3.93	9,226	5.08	15,125	8.64	114,340	9.74	134,690
12	3.86	9,016	3.80	8,135	3.89	9,216	5.08	15,519	7.94	101,500	9.18	124,330
13	3.84	8,966	3.81	8,177	3.89	9,266	5.48	15,839	7.60	95,430	9.03	121,555
14	3.82	8,936	3.78	8,220	3.90	9,356	5.88	16,198	7.21	88,565	9.03	121,555
15	3.79	8,956	3.74	8,301	3.96	9,506	6.18	16,698	6.91	83,343	9.37	127,845
16	3.77	9,048	3.76	8,423	3.96	9,726	6.48	17,178	6.72	80,064	10.62	150,970
17	3.74	9,110	3.78	8,634	3.97	10,016	8.88	17,919	6.72	80,064	12.62	188,710*s*
18	3.72	9,130	3.85	8,914	4.03	10,216	4.18	18,609	6.93	83,689	14.21	218,865
19	3.70	9,134	3.92	9,293	4.00	10,326	4.58	19,364	7.63	95,964	14.44	223,675
20	3.67	9,027	3.93	9,712	4.00	10,396	4.58	20,268	8.99	120,815	14.43	224,230
21	3.70	8,896	3.94	10,010	4.10	10,406	5.08	21,012	9.85	136,725	15.34	241,805
22	3.72	8,765	3.95	10,368	4.10	10,346	5.28	27,764	10.60	150,600	15.29	241,620
23	3.85	8,615	3.96	10,767	4.10	10,226	5.38	28,838	10.80	154,300	15.24	241,250
24	3.80	8,455	3.97	11,247	4.10	10,126	5.27	29,042	10.50	148,750	14.89	235,515
25	3.78	8,224	4.15	11,837	4.05	10,106	5.01	40,774	10 09	141,165	14.54	229,780
26	3.77	8,054	4.31	12,397	4.00	10,096	4.91*b*	49,801	9.44	129,140	14.19	224,045
27	3.77	7,904	4.42	12,637	4.00	10,116	4.92	49,962	9.44	129,140	13.69	215,350
28	3.79	7,844	4.48	12,717	4.00	10,136	4.82	48,360	10.08	140,980	13.39	210,540
29	3.81	7,844	4.49	12,537	4.00	10,186	5.83	64,917	12.93	193,705	13.03	204,620
30	3.83	7,884	.....	.....	4.00	10,256	6.53	76,810	11.08	159,480	12.63	197,960
31	3.84	7,914	.....	.....	4.00	10,336	.....	.....	10.77	153,745	.....	.....

a Gauge height interpolated.
b Ice conditions, January 1 to April 26.
s Shifting conditions, June 17 to July 15.

DAILY GAUGE HEIGHT AND DISCHARGE of Peace river at Peace River, for 1916—*Concluded*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1....	12.19	190,375	7.39	99,902	4.31	40,765	3.26	26,060	3.44	28,080	3.48	10,813
2....	12.84	203,140	7.29	97,823	4.36	41,590	3.31	26,610	3.36	27,160	3.42	11,033
3....	11.44	177,980	7.14	94,724	4.22	39,280	3.46	28,320	3.30	26,500	3.49	10,813
4....	11.09	172,060	6.99	91,635	4.17	38,470	3.51	28,930	3.17	25,070	3.55	10,412
5....	11.59	182,050	7.09	93,694	4.17	38,470	3.71	31,535	2.98*b*	23,833	3.71	10,008
6....	15.86	261,785	7.09	93,694	4.22	39,280	3.51	28,930	2.82	22,811	3.73	9,638
7....	15.29	251,980	6.89	89,585	4.27	40,105	3.32	26,720	2.66	21,829	3.55	9,238
8....	15.09	248,835	6.79	87,535	4.22	39,280	3.15	24,850	2.60	21,307	3.46	8,858
9....	14.79	244,025	6.59	83,436	4.17	38,470	3.10	24,300	2.55	20,875	3.32	8,326
10....	14.39	237,365	6.54	82,416	3.98	35,440	3.05	23,800	2.54	19,023	3.19	7,805
11....	13.89	228,855	6.54	82,416	3.88	33,910	3.05	23,800	2.45	17,371	2.68	7,244
12....	13.19	216,460	6.44	80,376	3.78	32,480	3.01	23,400	2.35	14,919	2.47	6,953
13....	12.39	202,400	6.29	77,327	3.68	31,440	3.01	23,400	2.21	13,868	2.41	6,752
14....	11.79	192,040	5.96	70,770	3.68	31,140	2.96	22,936	1.80	13,067	2.40	6,702
15....	11.39	185,195*s*	5.69	65,505	3.68	31,140	2.97	23,027	1.35	12,397	2.40	6,802
16....	10.94	177,574	5.49	61,610	3.68	31,140	2.97	23,027	1.34	12,317	2.42	7,082
17....	11.44	188,624	5.44	60,660	3.54	29,320	3.32	26,720	1.08	12,467	2.44	7,050
18....	11.49	189,729	5.39	59,710	3.49	28,680	4.13	37,830	1.34	12,637	2.46	6,942
19....	11.19	183,099	5.09	54,120	3.39	27,490	4.68	46,910	1.91	12,537	2.47	6,962
20....	10.89	176,469	4.70	47,250	3.29	26,390	4.98	52,150	2.99	11,656	2.49	7,082
21....	10.44	166,524	4.45	43,075	3.24	25,840	4.79	48,825	3.85	11,636	2.51	7,052
22....	10.09	158,789	4.20	38,950	3.19	25,290	4.44	42,910	4.19	11,696	2.53	7,241
23....	9.59	147,739	4.00	35,750	3.19	25,290	4.19	38,790	4.13	11,665	2.54	7,301
24....	9.29	141,109	3.90	34,200	3.15	24,850	4.05	36,550	4.12	11,614	2.56	7,241
25....	9.04	135,584	3.90	34,200	3.10	24,300	3.90	34,200	4.07	11,494	2.58	7,401
26....	8.84	131,164	4.00	35,750	3.00	23,300	3.95	34,975	3.86	11,364	2.60	7,531
27....	8.54	124,566	4.11	37,510	2.90	22,390	3.70	31,400	3.57	11,273	2.61	7,481
28....	8.14	115,822	4.21	39,115	2.85	21,945	3.61	30,230	3.66	11,192	2.63	7,401
29....	7.89	110,418	4.26	39,940	2.95	22,845	3.56	29,580	3.54	11,013	2.65	7,391
30....	7.59	104,090	4.21	39,115	3.15	24,850	3.54	29,320	2.98	10,913	2.67	7,581
31....	7.44	100,946	4.41	42,415	.....	.....	3.52	29,060	.....	.....	2.69*b*	7,751

b Ice conditions, November 5 to December 31.
s Shifting conditions, June 17 to July 15.

MONTHLY DISCHARGE of Peace river at Peace River, for 1916

(Drainage area *x* square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square mile	Depth in inches on Drainage Acre	Total in Acre-feet
January	10,547	7,844	9,096	.....	.....	559,291
February	12,717	7,954	9,349	.....	.....	537,761
March	11,897	9,216	10,068	.....	.....	619,057
April	76,810	10,446	24,461	.....	.....	1,455,530
May	193,705	80,064	128,503	.....	.....	7,901,341
June	241,805	121,555	183,228	.....	.....	10,902,822
July	261,785	100,946	178,929	.....	.....	11,001,915
August	99,902	34,200	64,329	.....	.....	3,955,436
September	41,590	21,945	31,173	.....	.....	1,854,922
October	52,150	22,936	30,939	.....	.....	1,902,365
November	28,080	10,913	16,119	.....	.....	959,147
December	11,033	6,702	7,996	.....	.....	491,655
The year	.....	.....	.....	.....	.....	42,141,242

x As a large portion of the drainage area is unsurveyed, it is impossible to compute the area drained.

PEACE RIVER AT FORT VERMILION

Location.—On the SE. ¼ Sec. 23, Tp. 108, Rge. 13, W. 5th Mer., at the mounted police barracks, about one mile west of the Hudson's Bay Company's store. Winter section NE. ¼ Sec. 24, Tp., 108, Rge., 13, W. 5th. Mer.

Records available.—August 8, 1915, to November 5, 1915; December 16, 1915, to April 29, 1916, and August 17, 1916, to December 31, 1916.

Gauge.—Vertical staff; elevation of zero maintained at 66.50 feet. Winter gauge elevation of zero 68.81 feet.

Bench-mark.—Spike driven in four-inch poplar stump; 300 feet up stream from gauge, 150 feet from edge of river; assumed elevation 100.00 feet.

Channel.—One channel at all stages, shifting.

Discharge measurements.—Made from boat, about one and one-half miles below gauge at Hudson's Bay Company's east property line.

Winter flow.—River affected by ice from November to May.

Observer.—R. W. McLeod.

Remarks.—Gauge heights only are recorded from August 17, to December 31, 1916.

DISCHARGE MEASUREMENTS of Peace river at Fort Vermilion, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 3, 4	P. H. Daniells	1,100	19,196	0.63	3.12	12,109
Jan. 5, 6	do	1,100	19,079	0.60	3.09	11,429
Jan. 7, 8	do	1,095	18,980	0.62	3.14	11,744
Jan. 11, 12, 13	do	1,090	18,742	0.53	2.70	9,922
Jan. 14, 15	do	1,085	18,542	0.53	2.63	9,795
Jan. 17, 18	do	1,085	18,396	0.55	2.62	10,084
Jan. 31, Feb. 1, 2	do	1,085	18,430	0.49	2.40	9,048
Feb. 4, 5	do	1,085	18,364	0.46	2.40	8,519
Feb. 7, 8	do	1,085	18,136	0.45	2.31	8,148
Feb. 11, 12	do	1,085	17,671	0.45	2.22	7,942
Feb. 14, 15	do	1,080	17,556	0.43	2.12	7,542
Feb. 16, 17	do	1,080	17,264	0.43	2.08	7,479
Feb. 18, 19	do	1,080	17,218	0.44	2.03	7,569
Feb 22, 23	do	1,080	17,109	0.43	1.95	7,308
Feb. 25, 26	do	1,080	17,020	0.45	1.97	7,678
Mar. 3, 4, 5	do	3,400	26,741	0.46	.....	12,282x
Mar. 8, 9	do	1,075	17,844	0.63	2.92	11,165
Mar. 10, 11	do	1,075	17,796	0.59	2.80	10,549
Mar. 14, 15	do	1,075	17,562	0.48	2.42	8,407
Mar. 17, 18	do	1,075	17,213	0.49	2.40	8,432
Mar. 20, 21	do	1,075	17,240	0.51	2.47	8,824
Mar. 23, 24	do	1,075	17,371	0.54	2.65	9,354
Mar. 27, 28	do	1,065	17,386	0.55	2.83	9,649
Mar. 31, April 1	do	1,060	17,426	0.53	2.77	9,313
April 4, 5	do	1,065	16,983	0.55	2.74	9,339
Aug. 17	do	1,694	34,319	1.89	11.25	65,236

x Measurement taken at Chutes; no gauge.

DAILY GAUGE HEIGHT AND DISCHARGE of Peace river at Fort Vermilion, for 1916

Day	January		February		March		April	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.10*b*	12,000	2.42	9,050	2.75	10,550	2.76	9,300
2	3.10	12,050	2.40	8,870	2.82	11,120	2.77	9,310
3	3.11	12,050	2.38	8,700	2.95	11,550	2.74	9,300
4	3.12	12,000	2.41	8,560	2.94	11,520	2.73	9,300
5	3.09	11,500	2.39	8,450	2.94	11,450	2.75	9,340
6	3.08	11,500	2.37	8,290	2.93	11,360	2.74	9,360
7	3.14	11,725	2.33	8,200	2.92	11,250	2.74	9,470
8	3.15	11,700	2.31	8,080	2.92	11,200	2.81	9,620
9	3.05	11,250	2.31	8,040	2.90	11,100	2.95	11,000*e*
10	2.95	10,700	2.30	8,000	2.84	10,750	3.19	12,000
11	2.90	10,110	2.28	7,970	2.77	10,320	4.24	15,000
12	2.76	9,900	2.17	7,910	2.66	9,630	5.09	17,000
13	2.67	9,800	2.16	7,750	2.59	9,000	6.69	23,000
14	2.63	9,750	2.17	7,620	2.45	8,500	7.99	28,000
15	2.62	9,780	2.12	7,530	2.39	8,330	9.09	34,000
16	2.61	9,950	2.08	7,480	2.39	8,310	10.04	41,000
17	2.61	10,100	2.08	7,480	2.39	8,340	11.19	57,000
18	2.62	10,200	2.04	7,500	2.39	8,500	11.74	66,000
19	2.63	10,225	2.01	7,570	2.41	8,610	12.54	71,000
20	2.64	10,230	2.00	7,500	2.44	8,750	14.74	101,000
21	2.60	10,150	1.97	7,380	2.49	8,950	13.49	81,000
22	2.59	10,040	1.95	7,300	2.54	9,120	12.29	70,000
23	2.55	9,920	1.95	7,330	2.61	9,280	11.59	62,000
24	2.50	9,700	1.95	7,380	2.69	9,440	15.49	105,000
25	2.46	9,500	1.97	7,540	2.72	9,530	14.09	90,000
26	2.43	9,270	1.98	7,850	2.80	9,620	12.94	79,000
27	2.43	9,170	2.16	8,370	2.82	9,640	11.44	64,500
28	2.42	9,110	2.37	9,000	2.83	9,650	10.99*b*	61,500
29	2.42	9,080	2.62	9,850	2.84	9,600	10.79	60,500*e*
30	2.42	9,060	.....	.....	2.82	9,480	.....	.....*x*
31	2.41	9,050	.....	.....	2.79	9,350	.....	.....

b Ice conditions January 1 to April 28.
e Discharge estimated April 9-29.
x No gauge height observations from April 30 to August 16.

DAILY GAUGE HEIGHT AND DISCHARGE of Peace river at Fort Vermilion, for 1916—*Concluded*

Day	August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*F et*	*Sec.-ft.*
1	.....	.....	8.84	.....	7.49	.....	7.39	.....	5.74	.....
2	.....	.....	8.94	.....	7.29	.....	7.19	.....	5.64	.....
3	.....	.....	8.94	.....	7.14	.....	6.99	.....	5.64	.....
4	.....	.....	8.94	.....	6.99	.....	6.94	.....	5.64	.....
5	.....	.....	8.94	.....	6.59	.....	6.84	.....	5.64	.....
6	.....	.....	8.84	.....	6.49	.....	6.84	.....	5.64	.....
7	.....	.....	8.74	.....	6.29	.....	6.84	.....	5.64	.....
8	.....	.....	8.69	.....	6.24	.....	6.84	.....	5.64	.....
9	.....	.....	8.64	.....	6.69	.....	6.69	.....	5.64	.....
10	.....	.....	8.59	.....	7.24	.....	6.64*b*	.....	5.64	.....
11	.....	.....	8.44	.....	7.29	.....	6.64	.....	5.64	.....
12	.....	.....	8.34	.....	7.24	.....	6.64	.....	5.64	.....
13	.....	.....	8.29	.....	7.59	.....	6.54	.....	5.64	.....
14	.....	.....	8.24	.....	7.34	.....	6.44	.....	5.64	.....
15	.....	.....	8.24	.....	7.09	.....	6.34	.....	5.64	.....
16	.....	.....	8.09	.....	6.89	.....	6.14	.....	5.64	.....
17	10.94	.....	7.94	.....	6.69	.....	5.84	.....	5.64	.....
18	10.79	.....	7.84	.....	6 59	.....	5.84	.....	5.54	.....
19	10.59	.....	7.79	.....	7.14	.....	5.84	.....	5.54	.....
20	10.39	.....	7.64	.....	7.79	.....	5.94	.....	5.44	.....
21	10.19	.....	7.59	.....	8.39	.....	5.94	.....	5.44	.....
22	9.99	.....	7.49	.....	8.99	.....	5.84	.....	5.34	.....
23	9.79	.....	7.29	.....	9.29	.....	5.84	.....	5.34	.....
24	9.59	.....	7.09	.....	8.99	.....	5.74	.....	5.34	.....
25	9.39	.....	6.89	.....	8.79	.....	5.74	.....	5.24	.....
26	9.19	.....	7.14	.....	8.39	.....	5.74	.....	5.24	.....
27	9.04	.....	7.19	.....	8.14	.....	5.74	.....	5.24	.....
28	9.04	.....	7.04	.....	8.04	.....	5.74	.....	5.14	.....
29	8.94	.....	7.09	.....	7.94	.....	5.74	.....	5.14	.....
30	8.79	.....	7.34	.....	7.89	.....	5.74	.....	5.14	.....
31	8.84	.....	.....	.....	7.69	.....	.....	.....	5.04*b*	.....

b Ice conditions November 10 to December 31.

MONTHLY DISCHARGE of Peace river at Fort Vermilion, for 1916

(Drainage area *x* square miles)

Month	Discharge in Second-Feet			Run-Off
	Maximum	Minimum	Mean	Total in Acre-feet
January	12,050	9,050	10,341	635,843
February	9,850	7,300	8,019	461,258
March	11,550	8,310	9,800	602,578
April (1–29)	105,000	9,300	42,224	2,428,753
The period	.....	.....	.....	4,128,432

x As a large portion of the drainage area is unsurveyed, it is impossible to compute the area drained.

MISCELLANEOUS DISCHARGE MEASUREMENTS made in Peace river drainage basin, in 1916

Date	Engineer	Stream	Location	Width	Area of Section	Mean Velocity	Discharge
				Feet	*Sq. ft.*	*Ft. per sec.*	*Sec.-ft.*
Sept. 18....	C. McGavin.....	Bear creek.....	NW. 16-81-6-6...	9	4.5	.....	Nil
Sept. 18....	do ...	Big Rat creek.....	NW. 11-80-5-6...	9	3.4	0.37	1.26
Oct. 5....	do ...	Burnt river.....	SE. 7-80-1-6.....	9	2.3	0.34	0.78
Sept. 19....	do ...	Montagneuse river..	NW. 31-83-6-6...	8	2.6	0.80	2.10
May 22....	H. S. Kerby.....	Patch creek.....	SW. 32-83-21-5..	16	16.0	1.63	26.00
July 8....	P. H. Daniells...	do	do	18	16.0	2.01	33.00
Jan. 27....	do ...	Red river.....	Tp. 108-5-5.....	60	81.0	0.12	9.90
Sept. 27....	C. McGavin.....	Spirit river.....	NW. 12-78-6-6..	9	6.8	.....	Nil
Jan. 21-22	P. H. Daniells...	Wabiskaw river....	Nr. Vermilion, Tp. 108-9-5 ..	254	431.0	0.73	317.00
Feb. 29— Mar. 1—..	do ...	do	do ..	254	376.0	0.91	343.00

ATHABASKA RIVER DRAINAGE BASIN

General Description

Athabaska river rises on the eastern slope of the Rocky mountains and flows in a north-easterly direction for about one thousand miles, eventually emptying into lake Athabaska.

The Athabaska basin forms the most southerly portion of the great MacKenzie system and the portion dealt with in this report comprises the headwaters only.

Rising in a country very similar to the watershed of the other streams of importance in Alberta, it flows out of the mountains and then through the foot-hill country. From the foot-hills to the lake the basin consists of stretches of muskeg and uplands, well timbered with spruce and pine.

The general character of the basin is such that the winter precipitation or snow cover is conserved to a great extent and floods in the early spring are not usual. However, in June, July and August rains and warm winds cause the upper parts of the system to discharge large quantities of snow water from the higher peaks and glaciers, and when rains of any magnitude occur the invariable result is a flood. The muskeg country is a great source of storage, but when its capacity is reached, it accelerates rather than retards the run-off.

The main transcontinental lines of the Grand Trunk Pacific and the Canadian Northern railways cross the upper portion of this drainage basin, and transportation is now a much easier problem than in the past.

Many valuable deposits of coal, limestone and other minerals are found in this basin, and, on account of these as well as the many power possibilities, and stretches of timber and pulpwood, it is expected that great developments will take place during the next few years.

A fuller description of this drainage basin was published as an appendix to the 1913 report, and a special report upon the floods in this drainage basin was published in an appendix to the 1915 report.

MIETTE RIVER NEAR JASPER

Location.—On the SW. ¼ Sec. 9, Tp. 45, Rge. 1, W. 6th Mer., at a traffic bridge about two miles southwest of Jasper and about one mile from the mouth of the river.

Records available.—May 23, 1914, to December 31, 1916. Discharge measurements during 1913 and winter of 1914.

Gauge.—Vertical staff, on downstream side of bridge pier, about twenty feet from the left bank and maintained at zero elevation of 3,383.41 feet since establishment.

Bench-marks.—Six-inch spike driven in fifteen-inch spruce tree on the left bank of the river and about thirty feet east of the gauge; elevation 3,395.17 feet (Grand Trunk Pacific railway).

Channel.—One channel divided by two bridge piers at all stages; slightly shifting.

Discharge measurements.—Made from the bridge.

Winter flow.—River affected by ice from November to April. Discharge measurements made at a point about 1,000 feet down stream from regular section, during winter.

Observer.—A. B. Webb.

Discharge Measurements of Miette river near Jasper, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 18	R. J. McGuinness	37.0	59.0	0.30	1.04	17.3
Jan. 25	do	37.0	52.0	0.28	0.84	14.7
Feb. 14	do	42.0	73.4	0.32	1.00	23.0
Mar. 28	do	42.0	87.2	0.44	2.00	38.0
April 10	do	72.0	193.0	0.44	1.65	86.0
May 8	do	75.0	334.0	1.22	2.71	407.0
May 30	C. McGavin	76.2	377.0	1.34	3.16	507.0
June 20	do	76.0	1,088.0	2.88	12.00	3,128.0*x*
June 22	do	75.9	958.0	2.58	9.72	2,471.0*x*
July 15	do	75.9	675.0	1.85	6.02	1,249.0
Aug. 6	do	76.1	530.0	1.50	4.64	795.0
Aug. 29	do	75.9	453.0	1.09	3.42	494.0
Sept. 18	W. T. Reeve	75.9	337.0	0.66	2.40	222.0
Oct. 13	do	75.9	325.0	0.59	2.16	192.0
Nov. 14	do	69.0	138.7	0.66	2.45	91.0
Dec. 4	do	67.0	98.8	0.78	1.96	77.0

x Slope measurement.

Daily Gauge Height and Discharge of Miette river near Jasper, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.26	38*b*	1.04	10	1.60	32	2.10	40	2.00	288	2.89	449
2	1.18	35	1.24	12	1.50	23	2.22	43	2.20	320	3.04	481
3	1.15	30	1.34	15	1.40	18	2.25	45	2.40	354	2.94	459
4	1.00	20	1.74	17	1.25	22	2.45	50	3.00	472	4.70	885
5	1.10	30	1.74	20	1.30	27	2.35	83	3.20	516	4.20	754
6	1.00	25	1.54	22	1.40	27	2.37	117	3.50	583	3.90	679
7	0.90	25	1.54	21	1.45	25	2.20	106	3.60	606	3.60	606
8	1.00	28	1.24	18	1.50	27	2.05	100	2.60	390	3.75	642
9	0.90	25	1.04	16	1.55	30	2.00	98	2.40	354	3.90	679
10	0.50	23	0.74	15	2.35	34	1.65	86	2.15	312	3.66	620
11	0.74	24	1.24	16	2.40	36	1.17	86	2.00	288	3.36	551
12	0.64	24	1.74	18	2.55	38	1.13	87	1.99	286	3.96	694
13	0.84	23	2.24	21	2.75	39	1.05	92	1.69	247	4.36	794
14	0.94	22	1.04	23	2.80	38	1.00	96	1.64	241	5.71	1,165
15	1.04	20	1.60	25	2.85	37	1.10	103*b*	1.58	234	5.96	1,235
16	1.09	20	1.58	27	2.70	36	0.77	157	1.43	216	9.37	2,295
17	0.94	18	1.60	29	2.65	36	0.80	159	1.48	222	9.97	2,487
18	1.04	17	1.45	33	2.50	36	0.75	156	1.98	285	10.47	2,647
19	1.24	16	2.00	35	2.32	35	0.73	154	2.92	455	10.97	2,807
20	1.14	15	2.25	37	2.30	35	0.70	152	2.97	466	11.97	3,127
21	1.17	15	2.30	40	2.24	35	0.69	151	2.97	466	11.27	2,903
22	1.19	15	2.48	39	2.20	35	0.67	150	2.57	385	9.73	2,411
23	1.21	15	2.45	38	2.15	36	0.60	146	2.61	392	9.48	2,331
24	1.24	15	2.40	38	2.10	37	0.65	149	2.66	402	9.03	2,187
25	1.34	15	2.30	39	2.05	38	0.63	148	2.81	432	8.98	2,171
26	1.44	11	2.25	40	2.00	38	1.00	173	2.85	440	8.68	2,075
27	1.74	10	2.00	39	2.00	38	1.75	254	3.70	630	9.48	2,331
28	1.94	5	1.90	37	1.78	38	1.68	246	3.45	572	9.03	2,187
29	1.44	4	1.70	35	1.82	35	1.55	230	3.25	527	8.98	2,171
30	1.09	5	.....	.....	1.98	38	1.45	218	3.16	507	8.58	2,043
31	0.99	6	.....	.....	2.00	38	.....	.....	3.09	492	.....	.....

b Ice conditions from January 1 to April 15.

DAILY GAUGE HEIGHT AND DISCHARGE of Miette river near Jasper, for 1916—*Concluded*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1....	8.28	1,947	4.98	893	4.17	668	1.97	173	1.96	172	1.97	86
2....	6.98	1,535	5.30	974	4.57	780	1.87	163	2.00	176	1.95	83
3....	7.78	1,787	6.61	1,336	4.22	682	1.82	158	2.00	176	1.95	80
4....	7.93	1,835	5.20	939	4.42	738	1.84	160	1.96	172	1.96	77
5....	6.98	1,535	5.05	898	4.57	780	1.87	163	1.96	172	1.78	74
6....	5.93	1,226	4.64*s*	799	3.72	547	1.97	173	2.00	176	1.80	70
7....	5.73	1,170	4.84	855	3.42	469	1.89	165	1.97	173	1.82	64
8....	5.75	1,176	4.95	886	3.22	417	1.87	163	1.91	167	1.80	58
9....	6.28	1,324	4.90	872	3.27	430	1.87	163	1.91	167	1.85	54
10....	8.53	2,027	4.86	861	3.12	392	1.84	160	1.96	125	1.89	52
11....	8.48	2,011	4.86	861	2.97	355	1.97	173	2.06	84	1.90	52
12....	8.61	2,052	4.72	822	2.92	344	2.07	185	2.26	85	1.90	52
13....	9.98	2,491	4.71	819	2.52	256	2.16	197	2.36	88	2.03	53
14....	6.80	1,479	4.88	866	2.27	212	2.52	256	2.47	91	2.05	54
15....	4.24	764	5.19	955	2.47	246	2.97	355	2.40	94	2.03	55
16....	6.08*s*	1,268	5.54	1,057	2.47	246	4.07	641	2.30	95	2.00	55
17....	6.88	1,494	4.90	872	4.39	729	5.37	1,007	2.30	98	1.90	56
18....	6.54	1,388	4.10	649	4.39	729	4.96	889	2.15	102	1.89	55
19....	7.97	1,828	3.19	410	4.32	710	3.26	428	2.10	104	1.91	55
20....	7.31	1,615	3.02	367	4.32	710	3.16	402	2.05	107	1.91	55
21....	6.95	1,498	2.72	298	2.97	355	2.96	353	2.00	107	1.90	54
22....	6.15	1,260	2.93	346	3.72	547	2.56	264	2.00	103	1.90	52
23....	5.39	1,042	3.48	485	2.17	198	2.46	244	1.80	87	1.91	48
24....	5.03	939	3.59	513	2.22	205	2.41	234	2.00	87	1.91	44
25....	5.43	1,044	3.35	451	2.25	210	2.38	229	2.05	89	1.86	36
26....	5.92	1,179	3.35	451	2.25	210	2.26	211	2.08	90	1.86	30
27....	5.36	1,016	3.41	467	2.17	198	2.11	190	2.05	91	1.91	28
28....	5.11	944	3.41	467	2.12	192	1.99	175	2.00	91	1.99	27
29....	5.25	977	3.42	469	1.97	173	1.99	175	1.95	90	2.01	28
30....	4.89	877	3.62	521	2.02	179	1.96	172	1.98	88	2.06	30
31....	4.79	844	3.72	547	.....	.....	1.97	173	.....	.....	2.07	32

s Shifting conditions, July 16 to August 6.

MONTHLY DISCHARGE of Miette river near Jasper, for 1916

(Drainage area 250 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	38	4	19.2	0.077	0.09	1,181
February	40	10	27.0	0.108	0.12	1,553
March	39	18	33.0	0.132	0.15	2,029
April	254	40	129.0	0.516	0.58	7,676
May	630	216	399.0	1.596	1.84	24,534
June	3,127	449	1,562.0	6.248	6 97	92,945
July	2,491	764	1,406.0	5.624	6.48	86,452
August	1,336	298	710.0	2.840	3.27	43,656
September	780	173	430.0	1.720	1.92	25,587
October	1,007	158	277.0	1.108	1.28	17,032
November	176	84	118.0	0.472	0.53	7,021
December	86	27	53.0	0.212	0.24	3,259
The year	.....	.....	.....	.....	23.47	312,925

ATHABASKA RIVER AT JASPER

Location.—On the NW. ¼ Sec. 15, Tp. 45, Rge. 1, W. 6th Mer., about one-half mile east of the Grand Trunk Pacific railway station and three-quarters of a mile below the mouth of Miette river.

Records available.—March 4, 1913, to December 31, 1916.

Gauge.—Vertical staff, on left bank and 350 feet below cable.

Elevation of zero was maintained at 3,360.70 feet during 1913.

Elevation of zero was maintained at 3,360.68 feet during 1914-16.

Bench-mark.—Permanent iron bench-mark, fifty feet south of gauge; elevation 3,376.85 feet (Grand Trunk Pacific railway datum).

Channel.—Shifting.

Discharge measurements.—Made from a cable car.

Winter flow.—River affected by ice from November to April.

Observer.—A. B. Webb.

Accuracy.—Gauge heights were read at this station to one-hundredth of a foot, at approximately the same hour daily and are well within the required degree of accuracy.

The open water curve is well defined and regular, and passes through or very close to all of the discharge measurement points and very closely approaches exactitude.

The winter discharges are taken from a graph which was based on several winter discharge measurements, daily gauge height records and temperature records, and is fairly accurate.

DISCHARGE MEASUREMENTS of Athabaska river at Jasper, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 17	R. J. McGuinness	110	404	0.35	6.21	142
Jan. 24	do	110	384	0.35	6.01	134
Feb. 19	do	136	217	2.36	8.00	510
Mar. 30	do	120	128	3.63	0.55	465
April 10	do	145	145	5.07	1.03	734
May 8	do	224	341	5.20	2.62	1,772
June 2	C. H. McGavin	228	345	5.31	2.73	1,834
June 24	do	415	2,090	6.86	8.70	14,275
June 24	do	415	2,090	6.87	8.70	14,361 *x*
July 13	do	420	2,650	8.17	9.92	21,661
Aug. 3	do	414	1,580	6.39	7.66	10,101
Aug. 28	W. T. Reeve	371	1,162	6.19	6.56	7,194
Sept. 16	do	210	646	5.09	4.01	3,206
Oct. 14	do	184	332	4.74	2.70	1,573
Nov. 16	do	.....	.....	.....	1.86	980*e*
Dec. 5	do	156	223	3.07	1.57	685

e Discharge estimated from gauge height and velocity.
x Slope measurement.

DAILY GAUGE HEIGHT AND DISCHARGE of Athabaska river at Jasper, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.07*b*	530	5.36	315	5.90	450	0.64	505	1.88	1,140	2.66	1,668
2	2.87	530	7.01	330	6.10	470	0.69	530	2.23	1,341	2.73	1,727
3	2.97	525	9.21	355	6.00	480	0.72	542	2.58	1,604	2.97	1,950
4	2.47	475	9.01	370	5.80	490	0.89	576	2.88	1,862	3.75	2,780
5	3.68	440	8.61	390	5.70	490	0.86	605	2.98	1,960	3.63	2,643
6	3.98	470	8.51	400	4.00	480	0.91	642	3.13	2,110	3.35	2,335
7	2.58	490	8.01	410	4.50	470	0.99	698	3.18	2,160	3.40	2,390
8	2.68	425	8.01	415	3.30	455	1.02	720	2.62	1,636	3.55	2,555
9	4.99	385	8.21	420	3.20	450	1.04	727	2.32	1,404	3.73	2,756
10	5.39	370	8.11	430	2.00	440	1.03*b*	734	2.17	1,302	3.45	2,445
11	5.99	335	8.01	440	1.90	440	0.98	744	1.97	1,185	3.32	2,302
12	6.19	310	7.71	455	1.50	435	0.83	699	1.87	1,135	3.77	2,804
13	6.20	275	8.51	460	1.00	430	0.88	714	1.82	1,110	3.95	3,020
14	6.30	210	8.31	470	0.90	430	0.91	723	1.82	1,110	4.65	3,930
15	6.20	180	8.01	480	0.80	430	0.98	744	1.84	1,120	4.95	4,350
16	6.30	155	7.99	490	0.69	430	0.98	744	1.87	1,135	7.50	9,630
17	6.21	142	8.01	500	0.64	430	1.00	750	1.97	1,185	8.80	14,840
18	6.11	140	7.61	510	0.54	435	1.01	754	2.27	1,369	9.20	17,020
19	5.71	140	8.00	510	0.44	435	1.03	762	2.70	1,700	9.80	20,790
20	5.41	140	8.20	515	0.39	440	1.08	782	2.91	1,890	9.81	20,856
21	5.56*a*	140	7.00	510	0.44	445	1.06	774	2.96	1,940	9.20	17,020
22	5.71*a*	135	6.70	510	0.51	450	0.98	744	2.51	1,548	9.00	15,900
23	5.86*a*	135	6.00	510	0.53	455	0.93	729	2.56	1,588	8.90	15,360
24	6.01	134	6.00	500	0.49	460	0.98	744	2.41	1,468	8.70	14,340
25	6.41	135	5.70	495	0.54	460	0.76	678	2.46	1,508	8.40	12,920
26	6.21	140	5.50	480	0.54	460	1.23	842	2.59	1,612	8.39	12,877
27	6.01	160	5.00	470	0.52	465	1.68	1,040	2.96	1,940	8.79	14,790
28	5.71	180	5.10	455	0.55	465	1.87	1,135	3.06	2,040	8.68	14,242
29	5.51	205	5.50	445	0.57	465	1.58	990	2.96	1,940	8.68	14,242
30	5.21	235	.....	.....	0.59	465	1.38	902	2.84	1,826	8.18	12,002
31	5.16	280	.....	.....	0.61	488	.....	.....	2.82	1,808	.....	.....

a Gauge heights interpolated.
b Ice conditions, January 1 to April 10

DAILY GAUGE HEIGHT AND DISCHARGE of Athabaska river at Jasper, for 1916—*Concluded*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1....	7.97	11,212	7.08	8,450	6.97	8,178	3.05	2,030	2.40	1,460	1.41	750
2....	7.86	10,820	7.53	9,723	7.57	9,847	2.95	1,930	2.45	1,500	1.36	730
3....	7.52	9,692	7.66	10,138	7.47	9,540	2.75	1,745	2.50	1,540	1.41	715
4....	7.96	11,176	7.06	8,400	7.27	8,956	2.80	1,790	2.55	1,580	1.44	695
5....	7.61	9,973	6.42	6,894	6.97	8,178	2.94	1,920	2.55	1,580	1.57	685
6....	6.54	7,162	6.42	6,894	6.77	7,698	3.04	2,020	2.50	1,540	1.37	675
7....	6.43	6,916	7.06	8,400	6.57	7,231	2.69	1,692	2.45	1,500	1.32	670
8....	6.49	7,048	7.16	8,656	4.97	4,378	2.71	1,709	2.00	1,200	1.34	665
9....	7.43	9,420	7.79	10,576	5.47	5,152	2.69	1,692	1.91	1,155	1.22	660
10....	8.93	15,522	7.56	9,816	5.12	4,600	2.69	1,692	1.89*b*	1,050	1.43	655
11....	8.88	15,256	6.13	6,297	4.72	4,028	2.63	1,644	1.41	900	1.83	653
12....	8.93	15,522	5.98	6,024	4.47	3,681	2.75	1,745	1.46	920	1.86	650
13....	9.95	21,780	5.93	5,934	4.22	3,356	2.73	1,727	1.56	950	2.53	648
14....	8.90	15,360	6.79	7,746	3.97	3,044	2.70	1,700	1.61	950	2.63	645
15....	7.43	9,420	7.35	9,195	3.97	3,044	3.20	2,180	1.81	960	3.04	640
16....	6.97	8,178	7.95	11,140	4.01	3,092	4.15	3,265	1.86	980	2.44	635
17....	8.91	15,414	6.34	6,718	4.07	3,164	5.80	5,710	1.81	985	2.42	632
18....	7.95	11,140	6.14	6,316	4.12	3,226	5.00	4,420	1.86	985	2.44	628
19....	8.39	12,877	5.75	5,625	4.12	3,226	4.00	3,080	1.91	980	2.49	625
20....	7.94	11,104	5.05	4,495	4.17	3,291	3.90	2,960	1.91	960	2.54	623
21....	6.97	8,178	5.15	4,645	4.17	3,291	3.50	2,500	1.88	940	2.63	620
22....	6.71	7,554	5.05	4,495	4.06	3,152	3.20	2,180	1.86	900	2.65	600
23....	6.38	6,806	5.70	5,540	4.01	3,092	3.15	2,130	1.76	870	2.70	560
24....	6.93	8,082	6.06	6,168	4.26	3,408	3.05	2,030	1.77	860	2.75	520
25....	7.48	9,570	6.76	7,674	4.16	3,278	3.00	1,980	1.68	840	2.65	450
26....	7.36	9,214	6.51	7,093	4.11	3,213	2.92	1,900	1.71	820	4.05	440
27....	7.11	8,526	6.66	7,438	3.45	2,445	2.78	1,772	1.71	810	4.51	440
28....	7.02	8,300	6.56	7,208	3.37	2,357	2.75	1,745	1.66	800	5.06	440
29....	6.67	7,461	6.17	6,373	3.20	2,180	2.60	1,620	1.56	785	8.06*a*	440
30....	6.07	6,186	6.37	6,784	3.10	2,080	2.43	1,484	1.51	770	8.18*a*	445
31....	6.87	7,938	6.62	7,346	.....	.....	2.40	1,460	.....	.....	6.66*b*	448

a Gauge heights interpolated.
b Ice conditions, November 10 to December 31.

MONTHLY DISCHARGE of Athabaska river at Jasper, for 1916

(Drainage area 1576 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	530	134	276	0.175	0.20	16,971
February	515	315	450	0.286	0.31	25,884
March	490	430	454	0.288	0.33	27,915
April	1,135	505	742	0.471	0.53	44,152
May	2,160	1,110	1,570	0.996	1.15	96,535
June	20,856	1,668	8,889	5.636	6.29	528,575
July	15,522	6,186	10,413	6.607	7.62	640,270
August	11,140	4,495	7,361	4.671	5.38	452,610
September	9,847	2,080	4,514	2.864	3.20	268,602
October	5,710	1,460	2,176	1.381	1.59	133,797
November	1,580	770	1,069	0.678	0.76	63,610
December	750	440	603	0.383	0.44	37,077
The year	.....	.....	.....	.....	27.80	2,335,998

MALIGNE RIVER NEAR JASPER

Location.—On the SW. ¼ Sec. 1, Tp. 46, Rge. 1, W. 6th Mer., about four and one-half miles north-east of Jasper and about 400 feet from the confluence of the Maligne and Athabaska rivers.

Records available.—Discharge measurements from June 29, 1914, to December 31, 1916. Gauge heights were obtained from June 3, 1916, to November 15, 1916.

Gauge.—Vertical staff; also a Stevens continuous water stage recorder was installed on right bank about 100 feet up stream from cable tower on June 3, 1916.

Zero elevation of both gauges maintained at 91.62 feet since establishment.

Bench-mark.—Permanent iron bench-mark on right bank, about eighty feet from cable support; assumed elevation 99.53 feet.

Channel.—One channel at all stages; shifts during high stages.

Discharge measurements.—Made from a cable.

Winter flow.—Not affected by ice.

Accuracy.—The daily discharges computed are based on the mean daily gauge heights taken from the automatic gauge records and are well within the required degree of accuracy.

The open water discharge curves of which there are two, one previous and one subsequent to high water, pass through or very close to all the points except during high water when shifting conditions prevailed owing to the instability of the control, between July 15 and August 26. The results are within the maximum limit of error. No daily discharges were computed during the winter as the automatic gauge could not be used and the services of an observer were not obtainable.

DISCHARGE MEASUREMENTS of Maligne river near Jasper, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height		Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Staff ft.*	*Auto. ft.*	*Sec.-ft.*
Jan. 20	R. J. McGuinness	64	72	1.59	0.40	.....	114
Feb. 17	do	62	69	1.44	0.10	.....	99
April 1	do	64	69	1.47	0.60	.....	102
April 18	do	63	62	1.51	0.50	.....	94
May 9	C. McGavin	69	92	2.20	1.18	.....	202
May 29	do	73	130	3.20	1.64	.....	413
June 1	do	74	121	3.03	1.63	.....	367
June 23	do	91	265	6.30	3.59	3.61	1667
June 23	do	91	265	6.29	3.59	.....	1664*x*
July 15	do	100	375	8.52	4.80	4.81	3197*x*
Aug. 4	do	94	272	6.20	3.78	3.78	1690*s*
Aug. 26	do	96	252	6.09	3.84	3.80	1534*s*
Sept. 17	do	89	252	6.02	3.65	3.74	1519
Oct. 16	W. T. Reeve	78	146	3.52	2.56	2.56	541
Nov. 15	do	76	103	2.38	1.85	1.90	246
Dec. 6	do	71	80	2.16	1.56	.....	173

s Slope measurement.
x Shifting conditions.

Daily Gauge Height and Discharge of Maligne river near Jasper, for 1916

Day	June		July		August		September		October		November	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	3.44	1,508	3.78	1,684	3.79	1,540	3.57	1,326	2.26	382
2	.....	.....	3.45	1,517	3.79	1,684	3.81	1,561	3.48	1,242	2.23	368
3	.....	.....	3.46	1,526	3.81	1,694	3.81	1,561	3.39	1,164	2.16	337
4	1.90	496	3.59	1,645	3.82	1,694	3.81	1,561	3.30	1,088	2.18	346
5	1.92	506	3.49	1,551	3.82	1,684	3.82	1,572	3.13	950	2.19	350
6	1.94	516	3.45	1,517	3.81	1,664	3.81	1,561	2.94	802	2.14	329
7	1.93	511	3.43	1,500	3.81	1,664	3.80	1,550	2.74	658	2.04	290
8	1.94	516	3.47	1,534	3.81	1,654	3.79	1,540	2.62	578	2.05	294
9	1.97	531	3.62	1,674	3.81	1,645	3.79	1,540	2.48	494	1.98	270
10	1.98	536	3.86	1,926	3.80	1,635	3.79	1,540	2.41	456	1.90	245
11	1.99	541	4.08	2,185	3.79	1,616	3.78	1,530	2.28	391	2.05	294
12	2.04	566	4.32	2,501	3.78	1,598	3.77	1,520	2.28	391	1.97	267
13	2.10	597	4.65	2,966	3.79	1,607	3.77	1,520	2.37	435	1.95	261
14	2.30	705	4.90	3,326	3.79	1,598	3.77	1,520	2.42	461	1.96	264
15	2.62	899	4.79	3,197*s*	3.81	1,607	3.76	1,510	2.42	461	1.90	245
16	3.09	1,223	4.68	2,995	3.82	1,616	3.75	1,500	2.54	529	.....	.....
17	3.38	1,457	4.70	3,009	3.80	1,588	3.73	1,480	2.75	665	.....	.....
18	3.57	1,626	4.70	3,052	3.80	1,579	3.71	1,460	2.85	736	.....	.....
19	3.82	1,882	4.67	2,937	3.80	1,579	3.68	1,431	2.87	750	.....	.....
20	3.82	1,882	4.60	2,822	3.80	1,569	3.67	1,421	2.85	736	.....	.....
21	3.74	1,796	4.43	2,569	3.79	1,551	3.66	1,412	2.83	722	.....	.....
22	3.66	1,714	4.27	2,340	3.78	1,543	3.65	1,402	2.79	693	.....	.....
23	3.62	1,674	4.14	2,160	3.80	1,551	3.63	1,383	2.73	651	.....	.....
24	3.57	1,626	3.99	1,982	3.80	1,543	3.61	1,364	2.69	624	.....	.....
25	3.54	1,598	3.95	1,926	3 79	1,534	3.60	1,354	2.64	591	.....	.....
26	3.56	1,616	3.94	1,904	3.80	1,534*s*	3.59	1,345	2.58	553	.....	.....
27	3.57	1,626	3.89	1,839	3.80	1,550	3.59	1,345	2.50	505	.....	.....
28	3.54	1,598	3.87	1,807	3.79	1,540	3.58	1,335	2.42	461	.....	.....
29	3.49	1,551	3.85	1,775	3.78	1,530	3.57	1,326	2.37	435	.....	.....
30	3.47	1,534	3.82	1,744	3.78	1,530	3.57	1,326	2.32	410	.....	.....
31	.....	.....	3.81	1,724	3.78	1,530	.....	.....	2.28	391	.....	.....

s Shifting conditions July 15 to August 26.

Monthly Discharge of Maligne river near Jasper, for 1916

(Drainage area 455 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
June (4-30)	1,882	496	1,160	2.549	2.56	62,118
July	3,326	1,500	2,150	4.725	5.45	132,200
August	1,694	1,530	1,600	3.516	4.05	98,380
September	1,572	1,326	1,467	3.224	3.60	87,293
October	1,326	391	656	1.442	1.66	40,336
November (1-15)	382	245	303	0.666	0.37	9,015
The period	.....	.....	.....	.....	17.69	429,342

ROCKY RIVER AT HAWES

Location.—On the NE. ¼ Sec. 14, Tp. 48, Rge. 28, W. 5th Mer., about three-quarters of a mile east of Hawes station, and about three hundred yards from the point where the Rocky river enters the Athabaska river.

Records available.—June 9, 1913, to December 31, 1916.

Gauge.—Vertical staff on right bank of river and under Grand Trunk Pacific railway bridge; datum maintained at 3,273.81 feet since establishment.

Bench-mark.—On the NW. corner of concrete pier and ten feet from gauge; elevation 3,282.90 feet (Grand Trunk Pacific railway datum).

Discharge measurements.—Made from a bridge.

Winter flow.—River affected by ice from November to April. Discharge measurements made at a point about one mile above station.

Observer.—C. G. Smith.

DISCHARGE MEASUREMENTS of Rocky river at Hawes, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 3	R. J. McGuinness	30.0	11.00	1.10	1.24	12.1
Jan. 30	do	40.0	25.00	0.38	5.24	9.6
April 4	do	30.0	30.25	4.73	1.15	143.0
April 20	do	38.0	42.40	1.79	0.97	76.0
May 15	C. H. McGavin	58.5	73.47	2.32	1.46	171.0
June 5	do	99.0	146.00	4.77	2.50	699.0
June 27	do	153.6	369.00	5.50	4.46	2,029.0
July 17	do	107.0	383.00	4.70	3.28	1,798.0
Aug. 5	do	101.0	230.00	5.97	2.97	1,377.0
Sept. 21	W. T. Reeve	106.0	135.00	3.42	1.96	461.0
Oct. 20	do	105.0	158.60	4.68	2.30	744.0
Nov. 17	do	53.0	74.15	2.17	2.07	161.0
Dec. 8	do	45.0	34.65	1.41	2.04	49.0

Daily Gauge Height and Discharge of Rocky river at Hawes, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.50*b*	15	5.95	14	0.65	56	0.92	122	1.53	195	2.17	484
2	1.39*a*	14	5.77	14	0.77	57	1.05	129	1.63	239	2.19	495
3	1.28	12	5.50	15	1.15	58	1.10	137	1.92	355	2.23	518
4	2.50	14	5.67	16	1.35	58	1.15	143	2.13	463	2.66	831
5	4.00	15	5.46	16	1.70	58	1.05	130	2.08	437	2.45	664
6	3.50	17	4.70	16	1.82	58	1.30	164	2.06	426	2.39	621
7	3.45	17	4.45	17	1.90	60	1.45	186	2.05	421	2.38	614
8	3.00	16	4.05	18	3.20	60	1.70	220	2.03	411	2.40	628
9	2.50	14	3.80	20	5.06	61	2.90	230	1.96	375	2.43	650
10	2.50	13	4.21*a*	22	5.72	62	1.85	210	1.68	250	2.45	664
11	2.30	11	4.62*a*	26	5.70	64	1.06	135	1.69	254	2.39	621
12	2.50	10	5.03*a*	30	5.76	64	1.05	130	1.55	202	2.41	635
13	4.00	10	5.44*a*	33	5.66	66	1.10	110	1.54	199	2.50	700
14	3.00	10	5.85*a*	36	4.95	68	1.25	100	1.50	185	2.72	882
15	2.90	11	6.26*a*	38	5.00	69	1.08*b*	88	1.44	166	4.09	2,350
16	2.80	13	6.22	40	5.40	70	1.12	94	1.44	166	4.36	2,690*s*
17	4.70	14	6.12	40	5.65	71	1.05	85	1.52	192	4.69	3,040
18	4.80	16	6.05	40	5.70	72	1.00	80	1.67	247	5.08	3,440
19	4.90	18	6.06	41	5.60	74	1.00	80	1.82	309	5.26	3,590
20	5.60	18	6.05	42	5.55	76	0.97	77	2.13	463	5.24	3,500
21	5.00	14	5.35	44	5.60	78	0.93	74	2.09	442	4.95	3,050
22	4.20	12	5.19	44	5.52	80	0.90	71	2.03	411	4.62	2,580
23	3.80	10	5.15	46	5.40	82	0.92	73	1.92	355	4.44	2,290
24	3.40	8	5.03	48	4.00	84	0.95	76	1.87	332	4.47	2,250
25	3.30	8	4.36	49	2.01	86	0.94	75	1.87	332	4.45	2,160
26	3.30	6	4.68	50	1.05	87	1.05	85	1.86	327	4.45	2,090
27	4.00	6	4.08	51	1.01	90	1.33	136	1.93	360	4.54	2,130
28	5.80	6	4.63	52	1.00	96	1.45	169	2.19	495	4.69	2,350
29	4.00	8	4.20	54	0.95	102	1.37	146	2.22	512	4.57	2,260
30	5.90	10	.....	.....	1.00	108	1.31	130	2.20	500	4.44	2,160*s*
31	6.15	12	.....	.....	0.95	114	.....	.....	2.18	490	.....	.....

a Gauge height interpolated.
b Ice conditions January 1 to April 15.
s Shifting conditions June 16 to June 30.

DAILY GAUGE HEIGHT AND DISCHARGE of Rocky river at Hawes, for 1916.—*Concluded.*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1....	4.36	2,140*s*	2.94	1,384	2.62	1,049	1.91	421	1.82	360	2.51	100
2....	4.35	2,170	2.98	1,427	2.75	1,184	1.88	400	1.84	373	2.36	78
3....	4.44	2,340	3.07	1,524	2.75	1,184	1.85	380	1.81	354	2.06	57
4....	4.68	2,700	3.01	1,459	2.92	1,362	1.83	367	1.77	329	2.16	50
5....	4.14	2,100	2.93	1,373	3.20	1,668	1.83	367	1.77	329	2.46	49
6....	3.75	1,720	2.83	1,268	3.07	1,524	1.81	354	1.73	306	1.99	47
7....	3.49	1,480	2.81	1,246	2.90	1,341	1.80	347	1.68	277	2.07	48
8....	3.40	1,440	2.83	1,268	2.72	1,152	1.77	329	1.65	262	2.04	49
9....	3.38	1,470	2.99	1,437	2.61	1,038	1.75	318	1.61	240	2.12	50
10....	3.38	1,520	2.91	1,352	2.56	988	1.75	318	1.57*b*	210	2.32	51
11....	3.31	1,500	2.68	1,110	2.50	927	1.75	318	1.49	176	2.35	52
12....	3.42	1,680	2.58	1,008	2.42	850	1.78	335	1.47	172	2.30	53
13....	3.40	1,710	2.53	957	2.32	757	1.84	373	1.45	168	2.60	55
14....	3.20	1,540	2.48	908	2.22	668	1.92	428	1.43	164	3.00	57
15....	3.12	1,520	2.58	1,008	2.17	625	2.00	490	1.43	162	2.90	58
16....	3.10	1,556*s*	2.69	1,121	2.15	608	2.41	841	1.41	160	2.60	59
17....	3.33	1,815	2.87	1,310	2.13	592	3.09	1,545	2.19	161	3.30	60
18....	3.39	1,883	3.02	1,470	2.11	575	2.85	1,288	2.17	171	4.03	64
19....	3.14	1,605	2.97	1,416	2.08	552	2.51	937	2.15	177	4.00	66
20....	3.08	1,534	2.84	1,278	2.02	505	2.32	757	2.14	179	3.20	66
21....	2.96	1,405	2.70	1,131	1.97	467	2.16	617	2.18	178	3.00	64
22....	2.90	1,341	2.65	1,080	1.95	452	2.09	559	2.04	166	2.85	61
23....	2.87	1,310	2.66	1,091	1.95	452	2.07	544	1.89	143	2.20	58
24....	2.76	1,194	2.92	1,362	1.94	444	2.03	513	1.78	125	2.30	57
25....	2.74	1,173	2.86	1,299	1.95	452	1.98	475	1.98	122	2.28	56
26....	3.09	1,545	2.70	1,131	1.97	467	1.95	452	2.08	127	3.10	55
27....	3.33	1,815	2.64	1,069	1.94	444	1.92	428	2.60	135	4.03	55
28....	3.30	1,781	2.56	988	1.90	413	1.88	400	3.25	136	3.10	56
29....	3.15	1,612	2.53	957	1.86	387	1.89	406	3.12	126	2.85	59
30....	2.99	1,437	2.48	909	1.87	394	1.87	393	2.98	114	2.62	65
31....	2.97	1,416	2.44	869	.....	.....	1.84	373	.....	.....	3.76*b*	74

s Shifting conditions July 1-16.
b Ice conditions from November 10 to December 31.

MONTHLY DISCHARGE of Rocky river at Hawes, for 1916.

(Drainage area 395 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	18	6	12	0.031	0.04	750
February	54	14	34	0.086	0.09	1,956
March	114	56	74	0.187	0.22	4,550
April	230	71	123	0.311	0.35	7,319
May	512	166	339	0.858	0.99	20,844
June	3,590	484	1,698	4.299	4.80	101,038
July	2,700	1,173	1,660	4.203	4.85	102,070
August	1,524	869	1,200	3.038	3.50	73,785
September	1,668	387	784	1.985	2.21	46,651
October	1,545	318	518	1.311	1.51	31,851
November	373	114	203	0.514	0.57	12,079
December	100	47	59	0.149	0.17	3,628
The year	.....	.....	.....	.....	19.30	406,521

SNAKE INDIAN (STONY) RIVER NEAR HAWES

Location.—On the NW. ¼ Sec. 26, Tp. 48, Rge. 28, W. 5th Mer., at the Canadian Northern railway bridge four miles west of Bedson siding and about six hundred yards above the confluence of the Snake Indian (Stony) and Athabaska rivers.

Records available.—Discharge measurements from January 5, 1914, to December 31, 1916. During 1916 gauge heights were obtained from August 8 to November 12.

Gauge.—Vertical staff on left bank of the river, attached firmly to wooden cribbing about fifteen feet above the bridge; elevation of zero was maintained at 83.88 feet.

Bench-mark.—Bench-mark is the top of upstream side of concrete abutment of bridge, left bank of river; assumed elevation 100.00 feet.

Channel.—Two channels under bridge spans. Shifting during high water.

Discharge measurements.—Made from the bridge.

Winter flow.—Affected by ice from November to April.

Observer.—J. G. Pollock.

DISCHARGE MEASUREMENTS of Snake Indian (Stony) river near Hawes, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 3	R. J. McGuinness	40	87	1.53	.....	133
Jan. 31	do	40	68	1.35	.....	93
Feb. 18	do	40	116	1.75	.....	203
April 19	do	60	208	1.03	.....	214
May 15	C. McGavin	77	249	1.47	.....	368
June 6	do	115	360	2.92	6.56	1,053
June 21	do	245	1,658	4.64	12.54	7,689*x*
June 26	do	218	869	3.42	9.43	2,969
July 18	do	213	742	3.29	8.80	2,445
Aug. 8	do	178	565	3.70	8.21	2,092
Aug. 31	W. T. Reeve	83	423	3.15	7.43	1,333
Sept. 19	do	82	333	1.96	6.31	654
Oct. 21	do	77	326	2.03	6.13	662
Nov. 18	do	90	379	0.85	7.60	320*e*
Dec. 9	do	76	297	0.62	6.41	185

e Discharge estimated, from area and velocity.

x Slope measurement.

Daily Gauge Height and Discharge of Snake Indian (Stony) river near Hawes, for 1916

Day	August		September		October		November	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	7.60	1,522	5.90	520	5.40	347
2	.....	.....	7.70	1,596	5.84	496	5.40	347
3	.....	.....	7.70	1,596	5.73	453	5.42	353
4	.....	.....	7.60	1,522	5.70	441	5.43	356
5	.....	.....	7.55	1,486	5.73	453	5.43	356
6	.....	.....	7.50	1,450	5.70	441	5.40	347
7	.....	.....	7.40	1,378	5.60	406	5.40	347
8	8.22	1,985	7.20	1,240	5.56	394	5.38	342
9	8.30	2,045	6 90	1,040	5.53	385	5.38	342
10	8.00	1,820	6.70	920	5.45	362	5.38	342
11	7.90	1,745	6.60	862	5.46	364	5.38	342
12	7.56	1,493	6.65	891	5.54	388	5.38	342
13	7.55	1,486	6.50	806	5.67	430	.....	.....
14	7.70	1,596	6.40	754	5.90	520	.....	.....
15	7.82	1,685	6.30	704	6.02	571	.....	.....
16	7.74	1,626	6.30	704	6.20	655	.....	.....
17	7.60	1,522	6.30	704	7.10	1,172	.....	.....
18	7.30	1,308	6.30	704	6.73	938	.....	.....
19	7.00	1,105	6.30	704	6.50	806	.....	.....
20	6.90	1,040	6.30	704	6.32	714	.....	.....
21	6.82	992	6.20	655	6.13	621	.....	.....
22	6.90	1,040	6.20	655	6.02	571	.....	.....
23	7.20	1,240	6.10	607	5.90	520	.....	.....
24	7.82	1,685	6.12	617	5.86	504	.....	.....
25	7.80	1,670	6.12	617	5.80	480	.....	.....
26	8.00	1,820	6.10	607	5.72	449	.....	.....
27	7.90	1,745	6.06	589	5.65	424	.....	.....
28	7.90	1,745	6.04	580	5.62	413	.....	.....
29	7.70	1,596	6.02	571	5.62	413	.....	.....
30	7.50	1,450	6.00	562	5.45	362	.....	.....
31	7.44	1,407	.....	.....	5.40	347	.....	.....

Monthly Discharge of Snake Indian (Stony) river near Hawes, for 1916

(Drainage area 911 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
August (8-31)	2,045	992	1,535	1.685	1.50	73,071
September	1,596	562	912	1.001	1.12	54,268
October	1,172	347	517	0.568	0.65	31,789
November (1-12)	356	342	347	0.381	0.17	8,259
The period	.....	.....	.....	.....	3.44	167,387

ATHABASKA RIVER NEAR HINTON

Location.—On the SE. ¼ Sec. 8, Tp. 51, Rge. 25, W. 5th Mer., about three miles west of the town of Hinton and just below the mouth of Prairie creek.

Records available.—Gauge heights and discharge measurements available from May 4, 1915, to December 31, 1916.

Gauges.—The summer gauge is a vertical staff on the left bank of the river and about eight hundred feet below the cable; datum maintained at 3,144.13 feet since establishment. The winter gauge is a vertical staff on the right bank of the river, just above the mouth of Happy creek, and about three miles below the summer gauge; datum maintained at 3,131.06 feet in winter 1915-16, and 3,130.22 feet in winter 1916-17.

Bench-marks.—For the summer gauge a permanent iron bench-mark is located on the left bank of the river and about fifteen feet from the gauge; elevation 3,154.02 feet (Grand Trunk Pacific railway datum). For the winter gauge a six-inch spike in a spruce stump on the right bank and about fifty feet up stream from the gauge; elevation 3,144.51 feet (Grand Trunk Pacific railway datum).

Discharge measurements.—Made from a cable.

Winter flow.—River affected by ice from November to April. Discharge measurements made near the winter gauge during the winter.

Observers.—L. A. Hoff, M. McLeod and J. H. Warner.

Accuracy.—The daily gauge heights are read to one-hundredth of a foot, at the same hour daily, and are reasonably accurate.

The discharge measurements were plotted and a curve, which was smooth and well defined, was drawn through or very close to all the points and the resulting daily discharges should be well within the limit of error.

The winter discharges are based on computations resulting from a plotting of temperatures, daily gauge heights and frequent meterings, and are fairly close estimates.

DISCHARGE MEASUREMENTS of Athabaska river near Hinton, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq.ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 4	R. J. McGuinness	210	912	0.92	3.64	843
Feb. 13	do	240	616	1.63	3.34	1,027
Feb. 21	do	240	532	1.54	3.26	820
Mar. 25	do	259	588	2.19	3.23	1,285
April 21	do	210	1,056	1.28	-0.12	1,347
May 13	C. H. McGavin	235	1,308	2.03	1.12	2,661
June 7	do	328	1,856	3.41	2.80	6,343
June 28	do	379	3,630	7.61	7.71	27,634
June 28	do	379	3,630	7.61	7.71	27,659*x*
July 19	do	378	3,384	7.61	7.17	25,766
Aug. 10	do	360	2,862	6.28	5.44	17,794
Sept. 1	W. T. Reeve	363	2,543	5.62	4.78	14,283
Sept. 22	do	315	1,844	3.48	2.81	6,428
Oct. 22	do	280	1,712	3.33	2.50	5,805
Nov. 19	do	250	1,300	1.42	2.69	1,851
Dec. 10	do	429	1,672	0.81	5.74	1,354

x Slope measurement.

DAILY GAUGE HEIGHT AND DISCHARGE of Athabaska river near Hinton, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*S.c.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.69*b*	760	3.43	925	2.86	815	3.02	1,120	1.07	2,597	2.34	5,064
2	3.67	800	3.41	925	2.88	815	3.06	1,200	1.24	2,846	2.34	5,064
3	3.73	840	3.44	925	3.01	815	3.01	1,250	1.44	3,154	2.29	4,935
4	3.65	843	3.43	930	2.91	815	1.01	1,330	1.68	3,572	2.58	5,724
5	3.63	843	3.43	940	2.96	820	0.96	1,370	1.98	4,196	2.94	6,822
6	3.60	845	3.47	945	2.91	825	0.86	1,470	2.16	4,614	3.08	7,284
7	3.76	850	3.45	950	2.50	825	0.51	1,560	2.25	4,835	2.85	6,530
8	3.70	850	3.37	950	2.98	845	0.24	1,630	1.87	3,957	2.84	6,498
9	3.71	850	3.40	960	2.95	875	0.18	1,670	1.72	3,650	2.84	6,498
10	3.60	850	3.39	975	3.51	920	0.16	1,660	1.65	3,515	2.84	6,498
11	3.51	845	3.34	980	3.81	960	0.38	1,575	1.53	3,301	2.80	6,370
12	3.56	845	3.32	1,000	3.83	1,045	0.57	1,400	1.33	2,982	2.67	5,983
13	3.51	845	3.33	1,027	3.47	1,100	0.71	1,360	1.10	2,640	2.92	6,756
14	3.48	845	3.53	1,015	3.26	1,155	0.76	1,350	1.02	2,525	3.25	7,870
15	3.41	845	3.87	1,000	3.21	1,195	0.91	1,350	0.97	2,454	4.20	11,680
16	3.38	850	4.05	975	3.57	1,230	1.01	1,350	0.97	2,454	5.62	18,204
17	3.45	875	4.11	950	3.77	1,225	0.93*b*	1,350	1.04	2,554	7.15	25,530
18	3.42	900	3.51	910	3.25	1,220	0.96	1,350	1.30	2,936	8.00	29,610
19	3.37	900	3.27	875	3.01	1,220	0.97	1,350	1.56	3,352	8.95	34,170
20	3.40	890	3.41	845	3.31	1,225	1.00	1,350	1.78	3,770	9.80	38,250
21	3.44	875	3.63	820	3.56	1,230	1.03	1,347	1.80	3,810	10.30	40,650
22	3.42	860	4.04	820	3.26	1,250	0.96	1,350	1.85	3,915	9.35	36,090
23	3.05	845	3.21	820	3.27	1,250	1.13	1,375	1.82	3,852	8.65	32,730
24	3.33	845	3.85	815	3.21	1,260	1.24	1,410	1.76	3,730	8.25	30,810
25	3.36	875	3.23	815	3.23	1,285	1.36	1,425	1.72	3,650	8.08	29,994
26	3.39	880	3.51	815	3.31	1,330	1.38	1,620	1.72	3,650	7.85	28,890
27	3.35	890	3.26	815	3.38	1,370	1.41	1,840	1.82	3,852	7.85	28,890
28	3.40	900	3.06	815	3.26	1,300	1.44	2,060	2.25	4,835	7.75	28,410
29	3.38	900	3.11	815	3.16	1,245	1.46	2,310	2.54	5,612	7.74	28,362
30	3.34	910	.....	.....	3.18	1,256	1.52	2,460	2.59	5,752	7.48	27,114
31	3.46	920	.....	.....	3.11	1,218	.....	.....	2.37	5,142	.....	.....

b Ice conditions January 1 to April 17. Winter gauge was used until April 30.

DAILY GAUGE HEIGHT AND DISCHARGE of Athabaska river near Hinton, for 1916.—*Concluded.*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	7.10	25,290	5.44	17,358	4.76	14,196	2.60	5,780	1.60	3,420	2.27	1,630
2	6.69	23,322	5.45	17,405	4.84	14,564	2.58	5,724	1.47	3,202	2.29	1,580
3	6.52	22,506	5.54	17,828	5.41	17,217	2.56	5,668	1.50	3,250	.....	1,550*e*
4	6.82	23,946	5.62	18,208	5.43	17,311	2.54	5,612	1.54	3,318	.....	1,500
5	7.05	25,050	5.49	17,593	5.30	16,700	2.49	5,472	1.50	3,250	.....	1,460
6	6.55	22,650	5.40	17,170	5.21	16,277	2.44	5,332	1.44	3,154	.....	1,420
7	5.82	19,146	5.02	15,392	4.95	15,070	2.42	5,276	1.36	3,028	.....	1,390
8	5.72	18,674	4.94	15,024	4.68	13,828	1.90	4,020	1.36	3,028	.....	1,370
9	6.08	20,394	5.17	16,089	4.46	12,830	1.70	3,610	1.40	3,090	.....	1,350*e*
10	6.85	24,090	5.41	17,217	4.15	11,465	1.44	3,154	1.31	2,951	5.74	1,354
11	7.32	26,346	5.73	18,721	3.51	8,839	1.40	3,090	1.28	2,906	.....	1,356*e*
12	7.35	26,490	4.94	15,024	3.29	8,014	1.57	3,369	1.17*a*	2,742	.....	1,370
13	7.72	28,266	4.77	14,242	3.21	7,726	1.67	3,553	1.06*a*	2,582	.....	1,380
14	8.18	30,474	4.87	14,702	3.19	7,656	1.74	3,690	0.95*a*	2,426	.....	1,380
15	7.65	27,930	5.01	15,346	3.11	7,384	2.02	4,286	0.84*a*	2,274	.....	1,380
16	6.62	22,986	5.26	16,512	3.03	7,119	2.12	4,518	0.72*a*	2,122	.....	1,400
17	6.65	23,130	5.51	17,687	2.97	6,921	3.34	8,198	0.60*a*	1,980	.....	1,400
18	7.08	25,194	4.21	11,724	3.06	7,218	4.12	11,336	0.48*a*	1,846	.....	1,400
19	7.08	25,194	4.66	13,736	2.92	6,756	3.82	10,072	2.69*b*	1,851	.....	1,400
20	6.84	24,042	4.17	11,551	2.96	6,888	3.50	8,800	2.72	1,860	.....	1,380
21	6.18	20,874	4.00	10,820	2.96	6,888	3.07	7,251	2.74	1,875	.....	1,360
22	5.87	19,386	3.83	10,113	2.82	6,434	2.52	5,556	2.44	1,780	.....	1,325
23	5.34	16,888	3.84	10,154	2.82	6,434	1.92	4,064	2.34	1,540	.....	1,300
24	4.99	15,254	4.55	13,235	2.84	6,498	1.89	3,999	2.36	1,580	.....	1,275
25	4.83	14,518	5.01	15,346	2.82	6,434	1.92	4,064	2.34	1,650	.....	1,250*e*
26	5.34	16,888	5.48	17,546	2.80	6,370	2.18	4,662	2.32	1,700	4.91	1,225
27	5.62	18,204	5.07	15,622	2.78	6,310	2.24	4,810	2.29	1,700	4.94	1,215
28	5.67	18,439	4.12	11,336	2.80	6,370	2.07	4,401	2.30	1,700	4.90	1,215
29	5.60	18,110	4.75	14,150	2.73	6,160	1.77	3,750	2.33	1,680	4.93	1,225
30	5.54	17,828	4.79	14,334	2.68	6,012	1.74	3,690	2.29	1,660	4.97	1,255
31	5.47	17,499	4.82	14,472	.....	.....	1.83	3,873	.....	.....	5.01*b*	1,300

a Gauge height interpolated.
b Ice conditions November 19 to December 31.
e Discharge estimated from winter curve; gauge height book lost by observer.

MONTHLY DISCHARGE of Athabaska river near Hinton, for 1916

(Drainage area 3,987 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	920	760	861	0.216	0.25	52,941
February	1,027	815	909	0.228	0.25	52,286
March	1,370	815	1,095	0.275	0.32	67,329
April	2,460	1,120	1,508	0.378	0.42	89,732
May	5,752	2,454	3,668	0.920	1.06	225,537
June	40,650	4,935	18,576	4.659	5.20	1,105,348
July	30,474	14,518	21,903	5.494	6.33	1,346,763
August	18,721	10,113	15,021	3.767	4.34	923,605
September	17,311	6,012	9,596	2.407	2.69	571,002
October	11,336	3,090	5,183	1.300	1.50	318,690
November	3,420	1,540	2,372	0.595	0.66	141,144
December	1,630	1,215	1,368	0.343	0.40	84,115
The year	.....	.....	.....	.....	23.42	4,978,492

MCLEOD RIVER NEAR THORNTON

Location.—On the NW. ¼ Sec. 3, Tp. 54, Rge. 16, W. 5th Mer., at the Thornton ferry, about one mile down stream from the mouth of Wolf creek and about two hundred feet south of E. Smith's ranch buildings.

Records available.—Gauge heights available from May 18, 1914, to December 31, 1916. Discharge measurements available from September 26, 1913, to December 31, 1916.

Gauge.—Vertical staff for high water and slope gauge for low water, directly under the ferry cable, on the right bank of the river. Datum maintained at 2,737.64 feet since establishment.

Bench-mark.—Permanent iron bench-mark on the right bank and about fifty feet up stream from gauge. Elevation 2,749.16 feet (Grand Trunk Pacific railway datum).

Channel.—One channel at all stages, fairly permanent.

Discharge measurements.—Made from a cable car and by wading.

Winter flow.—Stream affected by ice from November to April. Discharge measurements are made at a point about 1,000 feet above regular station during the winter.

Observer.—Edward Smith.

Accuracy.—Daily gauge heights are recorded at this station to tenths of a foot once daily and are well within the required degree of accuracy.

The daily discharges are taken from a curve plotted from nine open water meterings. The curve passes through five of the points plotted, and close to the remaining points which are equally divided on each side of this curve. The resulting computations are fairly accurate and well within the limit of error.

The winter discharges are derived from a graph based upon daily gauge height records, temperatures and regular winter measurements, and are reasonably accurate.

DISCHARGE MEASUREMENTS of McLeod river near Thornton, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 5	R. J. McGuinness	120	196	0.67	2.02	131
Jan. 14	do	120	189	0.51	2.08	96
Feb. 23	do	75	124	0.62	2.25	77
Mar. 21	do	90	186	0.81	2.88	150
April 6	do	235	576	1.90	3.94	1,093
April 24	do	283	533	1.46	1.89	781
May 17	C. H. McGavin	257	503	1.57	2.05	793
June 10	do	307	835	2.33	3.46	1,950
July 1	do	333	1,150	2.89	4.39	3,318
July 1	do	333	1,150	2.89	4.39	3,323*x*
July 5	do	367	2,237	4.62	7.57	10,346*x*
July 21	do	296	790	2.29	2.92	1,811
Aug. 11	do	298	792	2.42	3.26	1,914
Sept. 4	W. T. Reeve	304	785	2.09	2.96	1,638
Sept. 25	do	283	482	1.53	1.88	735
Oct. 23	do	298	709	2.00	2.79	1,421
Nov. 21	do	279	536	0.95	2.33	510
Dec. 12	do	170	356	0.76	1.86	271

x Slope measurement.

Daily Gauge Height and Discharge of McLeod river near Thornton, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.00*b*	158	2.14	72	2.30	62	3.00	857	2.76	1,405	4.79	3,979
2	2.00	152	2.14	77	2.30	60	3.10	884	3.76	2,463	4.09	2,896
3	2.00	147	2.14	78	2.40	60	3.50	918	4.45	3,423	4.09	2,896
4	2.00	140	2.14	80	2.40	60	3.60	957	4.15	2,980	4.69	3,808
5	2.00	131	2.13	79	2.40	60	3.90	1,076	4.15	2,980	4.59	3,644
6	1.99	123	2.23	78	2.40	66	3.90	1,093	3.54	2,206	4.09	2,896
7	1.99	117	2.13	76	2.50	71	3.90	1,076	3.34	1,986	3.69	2,378
8	1.99	109	2.13	70	2.50	80	4.39	1,216	3.03	1,667	3.49	2,149
9	1.99	100	2.13	70	2.50	88	4.39	1,216	2.83	1,470	3.49	2,149
10	1.99	95	2.12	70	2.50	93	4.49	1,264	2.52	1,191	3.59	2,263
11	1.98	92	2.12	69	2.60	104	4.29	1,170	2.32	1,033	3.59	2,263
12	2.08	92	2.12	69	2.60	113	3.09	1,260	2.11	885	3.59	2,263
13	2.08	93	2.12	70	2.60	120	3.09	1,260	2.11	885	3.59	2,263
14	2.08	96	2.22	70	2.60	120	2.89	1,167	2.00	812	3.89	2,627
15	2.08	93	2.21	70	2.60	120	2.69	1,073	2.00	812	3.99	2,759
16	2.07	90	2.21	71	2.60	121	2.59	1,027	2.10	878	4.29	3,181
17	2.07	85	2.21	72	2.60	125	2.79	1,120	2.09	871	4.19	3,036
18	2.07	83	2.21	74	2.60	132	2.59	1,027	2.09	871	4.19	3,036
19	2.07	80	2.21	76	2.60	138	2.49	950	2.09	871	4.19	3,036
20	2.07	80	2.21	77	2.70	143	2.09	785	2.19	939	4.59	3,644
21	2.06	76	2.21	78	2.80	150	1.99	745	2.39	1,086	6.79	8,404
22	2.06	73	2.21	79	2.80	190	1.99	745	2.49	1,166	5.69	5,728
23	2.06	72	2.20	77	2.80	270	1.99*b*	745	2.29	1,011	4.69	3,808
24	2.06	70	2.20	77	2.80	328	1.89	742	2.29	1,011	4.19	3,036
25	2.06	69	2.20	73	2.80	365	1.89	742	2.39	1,086	3.99	2,759
26	2.15	68	2.20	70	2.90	420	1.88	736	2.49	1,166	3.99	2,759
27	2.15	67	2.20	70	2.90	485	2.28	1,004	2.59	1,251	3.99	2,759
28	2.15	64	2.20	68	2.90	550	2.67	1,323	2.79	1,433	4.19	3,036
29	2.15	65	2.20	65	2.90	610	2.77	1,414	2.99	1,626	3.99	2,759
30	2.15	67	.....	.....	3.00	695	2.76	1,405	3.09	1,728	3.89	2,627
31	2.14	70	.....	.....	3.00	790	.....	.....	3.49	2,149	.....	.....

b Ice conditions January 1 to April 23.

DAILY GAUGE HEIGHT AND DISCHARGE of McLeod river near Thornton, for 1916.—*Concluded.*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.40	3,346	3.83	2,550	2.29	1,011	1.86	724	2.20	946	1.94	420
2	4.19	3,036	3.54	2,206	2.59	1,251	1.86	724	2.10	878	1.94	420
3	3.89	2,627	3.44	2,094	2.69	1,341	1.87	730	2.10	878	1.94	395
4	4.88	4,135	3.44	2,094	3.10	1,738	1.87	730	2.00	812	1.93	360
5	7.57	10,432	3.85	2,576	3.10	1,738	1.77	671	1.80	688	1.83	330
6	6.47	7,585	3.55	2,217	3.00	1,636	1.77	671	1.71	638	1.82	310
7	5.96	6,336	3.35	1,997	2.80	1,442	1.87	730	1.51	531	1.82	300
8	5.56	5,451	3.16	1,799	2.70	1,350	2.07	858	1.41	481	1.82	290
9	5.16	4,654	3.06	1,697	2.59	1,251	2.07	858	1.71	638	1.81	270
10	4.95	4,260	3.36	2,008	2.69	1,341	1.98	799	1.01	299	1.81	270
11	4.65	3,742	3.27	1,913	2.59	1,251	1.98	799	1.12*b*	340	1.81	270
12	4.24	3,108	2.97	1,606	2.49	1,166	1.98	799	1.32	400	1.90	270
13	4.04	2,827	2.87	1,508	2.39	1,086	1.98	799	1.62	550	1.90	270
14	3.93	2,680	2.67	1,323	2.28	1,004	1.98	799	1.82	560	1.91	270
15	3.63	2,309	2.57	1,234	2.18	932	1.98	799	1.82	560	2.01	270
16	3.43	2,083	2.57	1,234	2.08	865	2.09	871	2.13	555	2.02	265
17	3.32	1,965	2.87	1,508	2.08	865	2.29	1,011	2.33	550	2.02	265
18	3.32	1,965	3.07	1,707	1.98	799	2.69	1,341	2.33	535	2.03	260
19	3.31	1,955	3.08	1,718	1.87	730	2.69	1,341	2.13	520	2.03	250
20	3.11	1,748	3.08	1,718	1.87	730	2.59	1,251	2.23	520	2.04	230
21	2.90	1,536	2.98	1,616	1.77	671	2.59	1,251	2.38	510	2.04	205
22	2.80	1,442	2.88	1,517	1.77	671	2.69	1,341	2.38	465	2.05	185
23	2.80	1,442	2.78	1,424	1.77	671	2.80	1,442	2.38	405	2.05	170
24	2.61	1,269	2.68	1,332	1.77	671	2.70	1,350	2.27	400	2.06	165
25	2.61	1,269	2.58	1,243	1.76	666	2.70	1,350	2.17	405	2.06	165
26	2.71	1,359	2.38	1,079	1.76	666	2.70	1,350	1.96	410	2.07	175
27	5.22	4,768	2.39	1,086	1.96	786	2.80	1,442	1.96	415	2.07	195
28	5.72	5,794	2.29	1,011	1.96	786	2.60	1,260	1.96	415	2.08	215
29	5.12	4,578	2.19	939	1.86	724	2.50	1,174	1.95	420	2.08	225
30	4.63	3,709	2.19	939	1.86	724	2.30	1,018	1.95	420	2.09	230
31	4.23	3,094	2.19	939	.....	.....	2.20	946	.....	.....	2.09*b*	235

b Ice conditions November 11 to December 31.

MONTHLY DISCHARGE of McLeod river near Thornton, for 1916

(Drainage area 2,521 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	158	64	94	0.037	0.04	5,780
February	80	65	73	0.029	0.03	4,199
March	790	60	219	0.087	0.10	13,466
April	1,414	736	1,033	0.410	0.46	61,468
May	3,423	812	1,463	0.580	0.67	89,956
June	8,404	2,149	3,161	1.254	1.40	188,093
July	10,432	1,269	3,436	1.363	1.57	211,271
August	2,576	939	1,607	0.637	0.73	98,811
September	1,738	666	1,019	0.404	0.45	60,635
October	1,442	671	1,007	0.400	0.46	61,918
November	946	299	538	0.213	0.24	32,013
December	420	165	263	0.104	0.12	16,171
The year	.....	.....	.....	.....	6.27	843,781

PEMBINA RIVER AT ENTWISTLE

Location.—On the SW. ¼ Sec. 20, Tp. 53, Rge. 7, W. 5th Mer., directly under the Grand Trunk Pacific railway trestle about one and one-half miles west of the Entwistle station.

Records available.—Gauge heights available from May 8, 1914, to December 31, 1916. Discharge measurements available from December 19, 1913, to December 31, 1916.

Gauge.—Vertical staff, spiked to pile about twenty feet down stream from the cable and twenty feet from the right bank; datum maintained at 2,348.06 feet.

Bench-mark.—Permanent iron bench-mark on the right bank and twenty feet west of cable tower; elevation 2,364.60 feet (Grand Trunk Pacific railway datum).

Channel.—One channel at all stages, fairly permanent.

Discharge measurements.—Made from a cable car.

Winter flow.—River affected by ice from November to April; discharge measurements made at a point about 800 feet below regular station during the winter.

Observer.—A. Doucette.

Accuracy.—The gauge rod at this station is read to tenths of a foot and is observed at the same hour daily, and the results are fairly accurate.

The curve is smooth and regular and is plotted from ten open water measurements; it passes through six of the points and the remainder are close to it. The results are well within the error limit.

Winter records are based upon daily gauge heights, temperature records and frequent measurements, from which a graph is derived which is a fairly accurate estimate.

DISCHARGE MEASUREMENTS of Pembina river at Entwistle, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 8	R. J. McGuinness	80	145.0	0.32	1.93	47
Jan. 13	do	80	168.0	0.28	1.91	47
Feb. 9	do	75	114.0	0.33	1.90	38
Feb. 26	do	80	90.0	0.55	1.81	50
Feb. 28	do	80	97.5	0.57	1.91	56
March 20	do	80	95.0	0.54	2.40	51
April 8	do	150	240.0	1.47	3.42	353
April 26	do	153	606.0	0.76	1.58	459
May 20	C. H. McGavin	152	501.0	0.81	1.38	407
June 13	do	162	698.0	1.84	2.58	1,283
July 3	do	166	754.0	2.20	2.91	1,659
July 3	do	166	754.0	2.20	2.91	1,659*x*
July 5	do	179	1,444.0	4.16	6.68	6,000*x*
July 25	do	156	694.7	1.49	2.42	1,036
Aug. 15	do	153	577.0	1.17	1.86	677
Sept. 5	W. T. Reeve	157	719.0	1.76	2.49	1,270
Sept. 6	do	164	810.0	2.10	2.96	1,701
Sept. 28	do	151	539.0	0.97	1.38	523
Oct. 27	do	156	610.0	1.25	2.06	759
Nov. 22	do	145	412.0	0.80	1.56	329
Dec. 13	do	119	224.0	0.34	1.77	77
Dec. 30	do	119	235.0	0.41	1.82	95

x Slope measurement.

DAILY GAUGE HEIGHT AND DISCHARGE of Pembina river at Entwistle, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.70[b]	59	1.81	40	1.91	54	3.01	280	2.14	889	2.90	1,635
2	1.70	58	1.81	40	1.91	53	3.01	280	2.54	1,260	3.30	2,066
3	1.80	56	1.81	39	2.01	52	2.91	300	3.20	1,957	2.60	1,320
4	1.80	53	1.81	39	2.21	52	2.91	320	3.34	2,110	2.90	1,635
5	1.90	52	1.81	39	2.21	51	2.91	340	3.14	1,892	2.90	1,635
6	1.80	50	1.81	38	2.21	50	3.71	345	2.94	1,677	2.70	1,425
7	1.80	48	1.91	38	2.21	49	3.72	349	2.74	1,367	2.40	1,125
8	1.91	47	1.91	38	2.21	49	3.42	353	2.44	1,163	1.90	700
9	1.91	47	1.91	38	2.21	49	3.77	431	2.24	976	2.00	775
10	1.91	47	1.91	38	2.21	49	3.72	420	2.14	889	2.00	775
11	2.01	47	2.01	38	2.21	50	3.35	488	1.94	730	2.10	855
12	1.91	47	2.01	39	2.21	50	3.25	454	1.94	730	2.59	1,310
13	1.91	47	2.01	39	2.11	50	3.05	386	2.24	976	2.80	1,530
14	1.91	47	2.11	40	2.11	50	3.25	454	1.84	658	2.50	1,220
15	1.91	47	2.11	41	2.11	50	3.15	420	1.74	596	2.50	1,220
16	1.91	46	2.21	43	2.21	50	2.65	456	1.64	544	2.40	1,125
17	1.91	46	2.21	45	2.21	51	2.75	470	1.54	496	2.20	940
18	1.91	46	2.21	46	2.31	51	2.75	470	2.34	1,068	2.00	775
19	1.91	46	2.21	47	2.31	51	2.85	484	2.34	1,068	1.90	700
20	1.91	46	2.21	47	2.41	51	2.25	507	1.90	700	1.90	700
21	1.91	46	2.21	48	2.61	54	1.75	500	1.90	700	2.00	775
22	1.91	46	2.11	48	2.61	60	1.65	483	1.80	630	2.00	775
23	1.91	46	2.11	48	2.71	66	1.45	457	1.80	630	2.60	1,320
24	1.91	46	2.01	49	2.71	71	1.45	457	1.90	700	2.41	1,135
25	1.91	46	1.81	49	2.71	74	1.55[b]	458	1.90	700	2.11	864
26	1.91	45	1.81	50	2.81	80	1.58	515	2.00	775	2.01	783
27	1.91	44	1.81	52	2.81	85	1.55	501	2.70	1,325	1.91	708
28	1.91	43	1.81	56	2.91	92	1.65	549	2.30	1,030	1.91	708
29	1.91	42	1.81	56	2.91	100	1.75	602	2.30	1,030	1.91	708
30	1.91	42	.....	.....	3.01	170	1.95	738	2.20	940	2.11	864
31	1.91	42	.....	.....	3.01	238	.....	.....	2.30	1,030	.....	.....

[b] Ice conditions, January 1 to April 25.

DAILY GAUGE HEIGHT AND DISCHARGE of Pembina river at Entwistle, for 1916—*Concluded*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.11	864	2.89	1,624	1.70	574	1.51	483	1.89	693	1.88	248
2	2.61	1,330	2.39	1,115	1.84	658	1.51	483	1.85	665	1.80	248
3	3.92	2,747	2.34	1,068	1.98	760	1.56	506	1.70	574	1.82	235
4	6.61	5,916	2.39	1,115	2.33	1,058	1.51	483	1.65	549	1.94	225
5	5.01	4,012	2.40	1,125	2.62	1,341	1.52	487	1.71*b*	530	1.96	230
6	5.00	4,000	2.45	1,172	2.87	1,604	1.52	487	1.66	504	1.68	225
7	4.79	3,754	2.75	1,478	2.87	1,604	1.42	444	1.71	475	1.60	205
8	4.13	2,990	2.45	1,172	2.82	1,551	1.43	448	1.77	460	1.57	180
9	4.97	3,965	2.25	985	2.66	1,383	1.53	492	1.62	420	1.59	160
10	4.36	3,254	2.11	864	2.61	1,330	1.68	564	1.62	385	1.61	100
11	3.35	2,120	2.01	783	2.46	1,182	1.63	539	1.52	368	1.58	70
12	3.74	2,549	2.11	864	2.40	1,125	1.59	519	1.63	373	1.80	70
13	3.93	2,760	2.06	823	2.15	898	1.64	544	1.68	378	1.82	77
14	3.83	2,648	1.91	708	2.05	815	1.59	519	1.63	376	1.82	100
15	3.52	2,307	1.87	679	1.84	658	1.55	501	1.64	368	1.72	112
16	3.41	2,186	1.86	672	1.74	596	1.45	456	1.54	355	1.62	115
17	3.00	1,741	1.85	665	1.79	624	1.55	501	1.49	334	1.52	115
18	3.06	1,805	1.90	700	1.78	619	1.70	574	1.40	332	1.52	115
19	2.96	1,699	2.34	1,068	1.68	564	1.76	608	1.55	334	1.72	112
20	2.96	1,699	2.73	1,456	1.63	539	1.71	580	1.45	320	1.72	102
21	2.87	1,604	2.77	1,498	1.52	487	1.86	672	1.40	326	1.42	70
22	2.97	1,709	2.52	1,240	1.57	510	1.97	752	1.56	329	1.53	70
23	2.67	1,394	2.26	994	1.52	487	1.87	679	1.56	285	1.53	76
24	2.37	1,096	2.05	815	1.56	506	1.97	752	1.56	225	1.53	80
25	2.18	923	1.90	700	1.41	439	2.47	1,192	1.58	227	1.43	80
26	2.08	839	1.84	658	1.51	483	2.08	839	1.08	232	1.63	72
27	2.28	1,012	1.83	651	1.56	506	2.08	839	1.55	235	1.63	70
28	3.65	2,450	1.73	591	1.40	435	2.13	880	1.52	235	1.53	70
29	3.60	2,395	1.67	559	1.50	478	2.09	847	1.79	232	1.54	70
30	3.20	1,957	1.66	554	1.55	501	2.49	1,210	1.81	236	1.82	95
31	3.09	1,837	1.71	580	.....	.....	1.99	768	.....	.....	1.83*b*	95

b Ice conditions, November 5 to December 31.

MONTHLY DISCHARGE of Pembina river at Entwistle, for 1916

(Drainage area 1,753 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square mile	Depth in inches on Drainage Area	Total in Acre-feet
January	59	42	47	0.025	0.03	2,890
February	56	38	44	0.024	0.03	2,531
March	238	49	68	0.039	0.04	4,181
April	738	280	442	0.252	0.28	26,301
May	2,110	496	1,008	0.575	0.66	61,979
June	2,066	700	1,070	0.610	0.68	63,670
July	5,916	839	2,308	1.317	1.52	141,913
August	1,624	554	935	0.533	0.61	57,491
September	1,604	435	810	0.462	0.52	48,198
October	1,210	444	634	0.362	0.42	38,983
November	693	225	378	0.216	0.24	22,493
December	248	70	126	0.072	0.08	7,747
The year	.....	.....	.....	.....	5.11	478,377

LOBSTICK RIVER NEAR ENTWISTLE

Location.—On the NE. ¼ Sec. 30, Tp. 53, Rge. 7, W. 5th Mer., about two and one-half miles northwest of the village of Entwistle.

Records available.—Gauge heights available from July 11, 1913, to December 31, 1915. Discharge measurements available from February 20, 1913, to December 31, 1916.

Gauge.—Vertical staff at right bank and spiked to downstream side of bridge abutment; elevation of zero maintained at 2,366.19, since establishment.

Bench-mark.—Permanent iron bench-mark on right bank of river and about sixty feet west of the gauge; elevation 2,375.14 feet (Grand Trunk Pacific railway datum).

Channel.—Fairly permanent.

Discharge measurements.—Made from a bridge, or by wading.

Winter flow.—River affected by ice from November to April.

Observer.—A Doucette.

DISCHARGE MEASUREMENTS of Lobstick river near Entwistle, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 8	R. J. McGuinness	31	36.35	0.33	1.54	12.00
Jan. 13	do	31	20.05	0.31	1.44	6.20
Feb. 10	do	20	6.00	0.10	1.34	0.60
Feb. 26	do	30	4.00	0.05	1.30	0.20
Mar. 1	do	30	4.00	0.05	1.30	0.20
Mar. 20	do	30	9.50	0.10	1.49	0.97
April 8	do	50	40.75	2.37	2.88	97.00
April 26	do	68	71.90	2.08	1.51	149.00
May 21	C. McGavin	75	77.00	1.75	1.62	135.00
June 14	do	74	64.60	1.55	1.66	101.00
July 4	do	86	223.00	4.42	3.50	987.00x
July 25	do	81	120.50	2.65	2.25	320.00
July 25	do	81	120.50	2.65	2.25	320.00x
Aug. 15	do	76	84.30	2.19	1.82	185.00
Sept. 5	W. T. Reeve	76	114.00	2.76	2.16	314.00
Sept. 6	do	77	114.00	2.60	2.13	296.00
Sept. 28	do	75	82.75	1.85	1.79	153.00
Oct. 27	do	74	78.75	1.77	1.76	140.00
Nov. 23	do	57	110.00	0.91	3.02	100.00
Dec. 14	do	65	60.00	1.04	4.05	62.00

x Slope measurement.

DAILY GAUGE HEIGHT AND DISCHARGE of Lobstick river near Entwistle, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1....	1.10*b*	25	1.40	12	1.10	1	1.60	23	2.01	238	1.77	158
2....	1.10	23	1.40	11	1.10	1	1.60	24	2.21	329	1.97	223
3....	1.10	20	1.40	10	1.10	2	1.50	27	3.41	941	1.77	158
4....	1.10	17	1.40	7	1.10	2	1.50	35	3.21	837	1.47	96
5....	1.10	16	1.40	5	1.10	2	1.80	57	2.82	634	1.47	96
6....	1.10	13	1.40	3	1.10	2	2.20	76	2.12	287	1.37	81
7....	1.10	12	1.40	2	1.10	3	2.80	97	1.72	145	1.37	81
8....	1.10	12	1.40	2	1.10	4	2.88	97	1.62	122	1.27	69
9....	1.20	10	1.40	1	1.10	5	2.89*a*	100	1.53	105	1.28	70
10....	1.30	9	1.40	1	1.10	5	2.90	100	1.53	105	1.28	70
11....	1.30	8	1.40	2	1.10	4	2.90	105	1.43	90	1.38	82
12....	1.30	7	1.40	3	1.10	3	3.00	120	1.53	105	1.66	131
13....	1.30	6	1.40	4	1.10	3	3.20	150	1.64	127	1.48	97
14....	1.40	8	1.50	5	1.10	2	4.20	295	1.74	150	1.38	82
15....	1.40	12	1.50	5	1.30	1	4.20	295	1.64	127	1.38	82
16....	1.40	14	1.50	6	1.30	1	2.10	226	1.64	127	1.28	70
17....	1.40	14	1.60	6	1.30	1	2.20	250	1.55	109	1.28	70
18....	1.40	14	1.60	7	1.30	1	2.20	253	1.55	109	1.28	70
19....	1.30	12	1.60	6	1.30	1	2.30	256	1.45	92	1.18	60
20....	1.30	9	1.70	6	1.30	1	1.90	240	1.45	92	1.18	60
21....	1.20	7	1.60	5	1.30	2	1.60	190	1.46	94	1.28	70
22....	1.20	6	1.60	4	1.30	4	1.50	118	1.36	80	1.28	70
23....	1.10	6	1.60	3	1.40	5	1.30*b*	119	1.36	80	1.38	82
24....	1.40	7	1.50	2	1.40	6	1.20	62	1.36	80	1.37	81
25....	1.50	7	1.40	2	1.40	8	1.20	62	1.56	111	1.17	59
26....	1.50	8	1.30	1	1.50	10	1.20	62	1.76	155	1.17	59
27....	1.60	9	1.30	1	1.50	12	1.30	72	1.96	219	1.17	59
28....	1.70	10	1.30	1	1.60	13	1.50	100	1.66	131	1.17	59
29....	1.70	11	1.30	1	1.60	15	1.50	100	1.47	96	1.17	59
30....	1.60	12	.....	.....	1.70	20	1.80	165	1.47	96	1.17	59
31....	1.50	12	.....	.....	1.70	23	.....	.....	1.47	96	.....	.....

a Gauge height interpolated.
b Ice conditions January 1 to April 23.

DAILY GAUGE HEIGHT AND DISCHARGE of Lobstick river near Entwistle, for 1916—*Concluded*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.17	59	1.95	215	1.60	118	1.82	171	1.75	152	3.93	86
2	1.27	69	1.70	140	1.75	152	1.77	158	1.80	165	3.93	85
3	1.67	133	1.60	118	1.90	196	1.77	158	1.75	152	3.92	83
4	3.50	988	1.79	162	2.00	234	1.72	145	1.70	140	3.97	80
5	3.56	1,019	1.89	193	2.11	283	1.67	133	1.65	129	3.97	76
6	3.66	1,071	1.99	230	2.21	329	1.62	122	1.60	118	3.87	70
7	3.66	1,071	2.09	274	2.11	283	1.52	104	1.70	140	3.77	64
8	3.77	1,128	1.93	207	2.16	306	1.62	122	1.75	152	3.87	59
9	3.57	1,024	1.88	190	2.11	283	1.62	122	1.70	140	3.87	55
10	3.62	1,050	1.83	174	2.01	238	1.72	145	1.65	129	3.97	53
11	3.17	816	1.78	160	1.91	200	1.82	171	1.60	118	4.37	54
12	3.18	822	1.77	158	1.81	168	1.72	145	1.64*b*	117	4.07	56
13	3.28	874	1.67	133	1.71	142	1.62	122	1.79	119	4.07	60
14	3.18	822	1.62	122	1.66	131	1.67	133	1.99	122	4.06	62
15	2.88	666	1.61	120	1.61	120	1.82	171	2.29	123	3.81	64
16	2.48	458	1.50	100	1.61	120	1.72	145	2.39	123	3.81	64
17	2.39	415	1.60	118	1.61	120	1.77	158	2.59	120	3.81	63
18	2.39	415	1.65	129	1.61	120	1.82	171	2.79	117	3.81	61
19	2.29	367	1.70	140	1.66	131	1.78	160	2.79	113	2.86	58
20	2.29	367	1.65	129	1.71	142	1.73	148	2.89	109	2.76	56
21	2.20	324	1.75	152	1.66	131	1.68	136	2.79	105	2.56	54
22	2.30	372	1.70	140	1.71	142	1.73	148	2.73	103	2.36	54
23	2.35	396	1.60	118	1.81	168	1.78	160	3.02	100	2.36	53
24	2.30	372	1.50	100	1.86	184	1.78	160	3.13	98	2.36	54
25	2.21	329	1.45	92	1.91	200	1.83	174	3.09	95	2.16	54
26	2.21	329	1.40	85	2.11	283	1.93	207	3.10	93	2.06	54
27	2.31	377	1.45	92	1.91	200	1.93	207	3.68	92	2.07	54
28	2.30	372	1.40	85	1.77	158	1.75	152	3.78	90	2.07	55
29	2.56	499	1.40	85	1.82	171	1.80	165	3.83	89	2.07	56
30	2.20	324	1.45	92	1.87	187	1.90	196	3.93	87	2.07	58
31	2.10	278	1.50	100	.....	.....	1.80	165	.....	.....	2.10*b*	60

b Ice conditions November 12 to December 31.

MONTHLY DISCHARGE of Lobstick river near Entwistle, for 1916

(Drainage area 698 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	25	5	11	0.016	0.02	676
February	12	1	4	0.006	0.01	230
March	23	1	5	0.007	0.01	307
April	295	23	129	0.185	0.21	7,676
May	941	80	197	0.282	0.33	12,113
June	223	59	85	0.122	0.14	5,058
July	1,071	59	568	0.814	0.94	34,925
August	274	85	140	0.200	0.23	8,608
September	329	118	188	0.270	0.30	11,187
October	207	104	154	0.221	0.25	9,469
November	165	87	118	0.169	0.19	7,021
December	86	53	62	0.089	0.10	3,812
The year	.....	.....	.....	.....	2.73	101,082

SWAN RIVER NEAR KINUSO

Location.—On the NE. ¼ Sec. 23, Tp. 73, Rge. 10, W. 5th Mer. on the Edmonton, Dunvegan and British Columbia railway bridge, one-half mile east of Kinuso.

Records available.—May 19 to October 31, 1915, and April 14, 1916, to November 4, 1916.

Gauge.—Vertical staff; elevation of zero 85.58 feet.

Bench-marks.—(1) Marked on pier; assumed elevation 100.00 feet. (2) Spike driven in 8-inch cottonwood tree, 50 feet from left bank of river and 130 feet up stream from the bridge; assumed elevation 107.08 feet.

Channel.—Two channels at all times.

Discharge measurements.—Made from bridge.

Winter flow.—No winter measurements taken.

Observer.—J. Guisseppe.

Discharge Measurements of Swan river near Kinuso, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 14	C. M. O'Neil	146	862	0.40	5.83	367*e*
May 12	H. S. Kerby	125	586	1.59	4.99	929
June 6	P. H. Daniells	126	492	1.63	4.58	810
June 24	do	113	336	0.71	2.77	239
July 12	do	129	645	1.37	4.81	881
July 14	do	134	984	2.04	7.46	2,003
July 26	do	120	410	0.96	3.58	393
Oct. 14	C. McGavin	105	214	0.62	2.45	132
Nov. 4	do	116	371	0.24	3.82	89

e Discharge estimated from cross-section and velocity; ice was running.

DAILY GAUGE HEIGHT AND DISCHARGE of Swan river near Kinuso, for 1916

Day	April		May		June		July	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			4.95	942	4.62	805	2.74	182
2			4.60	797	4.74	854	2.92	219
3			6.20	1,467	4.52	765	3.27	311
4			6.90	1,765	4.14	614	4.82	887
5			7.38	1,971	4.47	745	8.82	2,591
6			7.15	1,872	4.48	749	8.62	2,505
7			7.00	1,808	4.18	629	9.77	2,999
8			6.45	1,572	4.01	564	8.02	2,247
9			6.18	1,459	3.78	480	7.22	1,903
10			6.35	1,530	4.83	498	6.67	1,666
11			5.20	1,047	6.18	1,459	5.97	1,370
12			4.78	871	7.93	2,208	5.12	1,013
13			4.48	749	7.88	2,186	6.17	1,454
14	4.78[b]	450	4.48	749	7.33	1,950	7.07	1,838
15	5.05	480	4.30	677	6.58	1,627	6.62	1,645
16	4.70	520	4.25	657	6.23	1,480	6.17	1,454
17	4.15[b]	560	4.30	677	5.83	1,312	5.52	1,181
18	4.05	579	4.22	645	5.25	1,068	6.52	1,602
19	4.22	645	4.25	657	5.08	997	6.07	1,412
20	4.30	677	4.42	725	5.43	1,144	5.60	1,215
21	4.05	579	4.76	863	4.63	809	4.82	887
22	4.05	579	5.31	1,093	3.93	534	4.37	705
23	4.00	560	5.61	1,219	3.58	410	4.57	785
24	4.18	629	5.16	1,030	2.72	178	4.32	685
25	4.18	629	4.66	822	2.57	151	3.92	530
26	4.40	717	4.36	701	2.47	136	3.62	424
27	4.62	805	4.06	583	2.17	99	3.37	342
28	5.20	1,047	3.99	556	2.40	126	3.67	442
29	5.95	1,362	3.77	476	2.47	135	4.27	665
30	5.35	1,110	4.20	637	2.57	151	3.82	494
31			4.57	785			3.67	442

[b] Ice conditions, April 14-17.

DAILY GAUGE HEIGHT AND DISCHARGE of Swan river near Kinuso, for 1916—*Concluded*

Day	August		September		October		November	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.42	357	1.87	72	1.69	58	4.12	94
2	3.07	256	1.82	68	1.73	61	3.95	92
3	2.80	193	1.82	68	1.83	68	3.90	90
4	3.62	424	1.90	74	1.93	76	3.90 *d*	89
5	3.17	282	2.06	88	2.31	114	.....	.....
6	2.67	169	2.16	98	2.43	130	.....	.....
7	2.50	140	2.21	103	2.51	142	.....	.....
8	2.54	146	2.06	88	2.41	127	.....	.....
9	2.57	151	2.01	83	2.49	139	.....	.....
10	2.64	163	2.01	83	2.51	142	.....	.....
11	2.82	197	2.01	83	2.51	142	.....	.....
12	3.07	256	2.01	83	2.56	150	.....	.....
13	2.77	187	1.96	79	2.51	142	.....	.....
14	2.60	156	1.91	75	2.42	129	.....	.....
15	2.40	126	1.91	75	2.40	126	.....	.....
16	2.30	113	2.01	83	2.30	113	.....	.....
17	2.22	104	1.99	81	2.35 *b*	112	.....	.....
18	2.14	96	1.96	79	2.55	111	.....	.....
19	2.12	94	1.89	73	2.62	110	.....	.....
20	2.02	84	1.81	67	2.72	109	.....	.....
21	2.07	89	1.66	57	3.08	108	.....	.....
22	2.32	116	1.59	54	3.22	107	.....	.....
23	2.22	104	1.53	51	3.30	105	.....	.....
24	1.97	80	1.51	50	3.45	104	.....	.....
25	1.97	80	1.53	51	3.58	103	.....	.....
26	1.94	77	1.56	52	3.68	102	.....	.....
27	2.02	84	1.59	54	3.70	101	.....	.....
28	2.02	84	1.53	51	3.72	98	.....	.....
29	2.02	84	1.51	50	3.85	96	.....	.....
30	1.94	77	1.59	54	3.92	96	.....	.....
31	1.92	76	.....	.....	4.05	95	.....	.....

b Ice conditions, October 17 to November 4.
d Actual measurement.

MONTHLY DISCHARGE of Swan river near Kinuso, for 1916

(Drainage area 873 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
April (14-30)	1,362	450	702	0.803	0.44	23,665
May	1,971	476	1,013	1.160	1.34	62,287
June	2,208	99	829	0.950	1.06	49,329
July	2,999	182	1,164	1.333	1.54	71,572
August	424	76	150	0.172	0.20	9,223
September	103	50	71	0.081	0.09	4,225
October	150	58	110	0.126	0.15	6,764
November (1-4)	94	89	91	0.104	0.01	722
The period	.....	.....	.....	.....	4.83	227,787

LESSER SLAVE LAKE AT GROUARD

Location.—On the SW. ¼ Sec. 19, Tp. 75, Rge. 14, W. 5th Mer., at Grouard, in the province of Alberta.

Established.—September 23, 1914, by F. R. Burfield.

Records available.—Gauge heights taken at regular intervals of several days from September 23, 1914, to December 31, 1916.

Gauge.—Vertical staff; elevation of zero maintained at 84.23 feet.

Bench-mark.—Spike at base of telegraph pole 15 feet southeast of easterly end of bridge; assumed elevation 96.33 feet.

Observer.—Chas. Nash.

DAILY GAUGE HEIGHT, IN FEET, of Lesser Slave lake at Grouard, for 1916

Day	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
1	5.44	.....	4.88	4.85	.....	.....	5.65	6.41	.....	.....	.....	.....
2	.....	5.03	.....	.....	.....	.....	.....	.....	6.27	.....	5.32	4.82
3	.....	.....	.....	.....	6.08	6.10	.....	.....	.....	.....	.....	.....
4	.....	.....	4.93	.....	.....	.....	.....	.....	.....	5.22	.....	.....
5	5.44	4.98	.....	4.85	.....	.....	5.75	6.22	.....	.....	5.27	.....
6	.....	.....	.....	.....	6.05	.....	.....	.....	5.47	.....	.....	4.83
7	.....	.....	.....	.....	.....	6.11	.....	.....	.....	5.16	.....	.....
8	5.44	.....	4.87	5.25	.....	.....	6.41	.....	.....	.....	.....	.....
9	.....	4.97	.....	.....	.....	.....	.....	6.30	5.22	.....	4.92	4.84
10	.....	.....	.....	5.98	6.09	6.00	.....	.....	.....	.....	.....	.....
11	.....	.....	4.86	.....	.....	.....	.....	.....	.....	5.01	.....	.....
12	5.44	4.96	.....	6.05	.....	.....	6.46	6.22	.....	.....	4.87	.....
13	.....	.....	.....	.....	6.15	.....	.....	.....	5.27	.....	.....	.....
14	.....	.....	4.90	.....	.....	5.95	.....	.....	.....	5.07	.....	.....
15	.....	.....	.....	6.38	.....	.....	6.56	.....	.....	.....	4.83	.....
16	.....	4.90	.....	.....	.....	.....	.....	5.97	5.57	.....	.....	.....
17	.....	.....	.....	.....	6.11	6.00	.....	.....	.....	.....	.....	.....
18	.....	.....	4.85	.....	.....	.....	.....	.....	.....	5.22	4.89	.....
19	.....	4.94	.....	6.57	.....	.....	6.46	6.02	.....	.....	.....	.....
20	.....	.....	.....	.....	6.13	.....	.....	.....	5.52	.....	.....	.....
21	.....	.....	.....	.....	.....	6.30	.....	.....	.....	4.97	.....	.....
22	5.05	.....	4.85	6.58	.....	.....	6.51	5.82	.....	.....	4.95	.....
23	.....	4.94	.....	.....	.....	.....	.....	.....	5.37	.....	.....	.....
24	.....	.....	.....	.....	6.12	6.00	.....	.....	.....	.....	.....	.....
25	.....	.....	4.85	.....	.....	.....	.....	.....	.....	5.02	4.96	.....
26	5.05	4.88	.....	5.75	.....	.....	6.46	5.77	.....	.....	.....	.....
27	.....	.....	.....	.....	.....	.....	.....	.....	5.33	.....	.....	.....
28	.....	.....	.....	.....	6.12	6.12	.....	.....	.....	5.12	.....	.....
29	5.04	.....	4.85	5.67	.....	.....	6.46	5.82	.....	.....	4.97	.....
30	.....	.....	.....	.....	.....	.....	.....	.....	5.27	.....	.....	.....
31	.....	.....	.....	.....	6.13	.....	.....	.....	.....	.....	.....	.....

Water frozen to bottom at gauge, January 15-22 and December 16-31.

LESSER SLAVE LAKE NEAR SAWRIDGE

Location.—On the SW. ¼ Sec. 15, Tp. 73, Rge. 6, W. 5th Mer., on a bay in Dog Island, three miles northwest of Sawridge.

Records available.—Gauge heights May 21, 1915, to December 31, 1916.

Gauge.—Vertical staff; on pile of Herman Niclas' landing pier on Dog Island; zero elevation maintained at 94.10 feet from May 21, 1915, to November 22, 1915; zero elevation maintained at 91.70 feet from November 23, 1915, to December 31, 1916.

All records have been reduced to this latter datum.

Bench-mark.—Six-inch spike in poplar tree, twenty feet from edge of lake, and eighty feet north of the gauge; assumed elevation 100.00 feet.

Observer.—Herman Niclas.

DAILY GAUGE HEIGHT, IN FEET, of Lesser Slave lake near Sawridge, for 1916

Day	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
1	2.60	2.80	2.44	2.35	2.65	3.37	3.46	3.84	3.11	2.84	2.74	2.28
2	2.69	2.69	2.54	2.34	2.64	3.47	3.46	4.04	3.21	2.79	2.64	2.18
3	2.68	2.69	2.53	2.34	2.64	3.47	3.46	3.94	3.21	2.84	2.54	2.08
4	2.77	2.69	2.53	2.34	2.64	3.47	3.86	3.84	3.41	2.83	2.69	2.18
5	2.66	2.59	2.43	2.33	2.63	3.47	3.66	3.88	3.36	2.88	2.80	1.98
6	2.75	2.59	2.53	2.33	2.63	3.57	3.66	3.93	3.36	2.83	2.75	1.88
7	2.75	2.59	2.42	2.33	2.63	3.58	3.66	3.83	3.11	2.73	2.80	1.88
8	2.74	2.59	2.52	2.32	2.83	3.58	3.71	3.98	3.21	2.83	2.61	1.88
9	2.73	2.59	2.52	2.32	2.73	3.68	3.76	4.18	3.51	2.78	2.76	1.88
10	2.62	2.59	2.52	2.22	2.78	3.78	3.96	4.23	3.35	2.78	2.96	1.88
11	2.71	2.58	2.52	2.31	2.83	3.68	3.86	3.78	3.45	2.83	2.62	1.88
12	2.70	2.58	2.41	2.31	2.84	3.68	3.86	3.63	3.35	2.73	2.52	2.08
13	2.70	2.68	2.51	2.21	2.84	3.68	4.15	3.78	3.20	2.83	2.52	2.18
14	2.69	2.68	2.51	2.20	2.94	3.68	3.95	3.83	3.15	2.78	2.63	2.18
15	2.68	2.67	2.51	2.30	2.94	3.68	3.90	3.68	3.20	3.08	2.53	2.18
16	2.67	2.67	2.50	2.30	2.94	3.58	3.85	3.73	3.15	2.62	2.63	2.18
17	2.66	2.67	2.50	2.29	2.94	3.58	3.85	3.62	3.10	2.77	2.54	2.18
18	2.65	2.67	2.39	2.29	2.89	3.48	4.15	3.67	3.15	2.67	2.64	2.18
19	2.65	2.56	2.49	2.39	2.95	3.37	4.10	3.67	3.30	2.87	2.84	2.28
20	2.64	2.56	2.39	2.28	3.10	3.47	4.15	3.62	3.20	2.77	2.45	2.28
21	2.63	2.56	2.38	2.38	3.20	3.47	4.15	3.67	2.90	2.77	2.65	2.28
22	2.72	2.56	2.38	2.48	3.20	3.57	4.05	3.67	3.14	2.67	2.45	2.28
23	2.71	2.55	2.48	2.47	3.15	3.57	3.95	3.67	2.89	2.77	2.56	2.28
24	2.71	2.55	2.47	2.47	3.15	3.57	4.00	3.57	2.89	2.73	2.46	2.28
25	2.71	2.55	2.37	2.47	3.16	3.57	4.04	3.47	2.99	2.73	2.56	2.28
26	2.71	2.55	2.37	2.36	3.26	3.47	4.04	3.42	3.24	2.78	2.57	2.28
27	2.71	2.54	2.36	2.36	3.31	3.47	3.94	3.42	3.09	2.88	2.37	2.28
28	2.70	2.44	2.36	2.36	3.26	3.37	3.94	3.42	2.89	2.73	2.57	2.28
29	2.70	2.44	2.36	2.55	3.36	3.47	3.99	3.41	3.09	2.73	2.18	2.28
30	2.80	.....	2.35	2.55	3.41	3.67	3.94	3.41	3.04	2.79	2.28	2.28
31	2.70	.....	2.35	.....	3.26	.....	3.94	3.21	.....	2.74	.....	2.28

LESSER SLAVE RIVER AT SAWRIDGE

Location.—On the SE. ¼ Sec. 7, Tp. 73, Rge. 5, W. 5th Mer., at the traffic bridge about 150 feet south of the Sawridge hotel.

Records available.—May 20, 1915, to December 31, 1916.

Gauge.—Vertical staff spiked to upstream pile of fifth bent of bridge from left bank. Elevation of zero maintained at 90.16 feet since establishment.

Bench-mark.—Spike driven in outside pile of north abutment; assumed elevation 100.00 feet.

Channel.—One channel at all stages. Shifts during high stages.

Discharge measurements.—Made from bridge.

Winter flow.—River affected by ice from November to April.

Observers.—C. J. Schurter and T. W. Lyllick.

Discharge Measurements of Lesser Slave river at Sawridge, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 24	C. M. O'Neil	140	708	0.97	2.62	685
Feb. 18	do	139	843	0.88	2.65	744
Feb. 21	do	138	846	0.90	2.64	764
Mar. 15	do	139	847	0.90	2.54	763
April 14	do	140	786	1.29	2.20	1,016
April 17	do	140	787	1.26	2.18	989
May 13	H. S. Kerby	158	910	1.53	3.10	1,392
June 7	P. H. Daniells	165	996	1.57	3.48	1,560
June 28	do	159	925	1.63	3.20	1,510
July 15	do	173	1,062	1.52	3.80	1,618
July 28	do	176	1,083	1.69	3.95	1,827
Oct. 19	C. McGavin	154	876	1.18	2.80	1,036
Nov. 6	do	150	868	1.37	2.60	1,188
Nov. 20	do	147	688	1.08	2.30	744
Dec. 16	do	138	707	1.06	2.40	753

Daily Gauge Height and Discharge of Lesser Slave river at Sawridge, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.80*b*	562	2.60	646	2.60	752	2.40	916	2.70	1,217	3.40	1,517
2	2.70	560	2.60	654	2.60	760	2.40	925	2.80	1,249	3.50	1,568
3	2.70	560	2.70	670	2.50	762	2.40	935	2.90	1,286	3.40	1,517
4	2.70	557	2.70	690	2.60	762	2.30	945	2.90	1,286	3.50	1,568
5	2.70	557	2.60	698	2.50	762	2.30	957	2.90	1,286	3.40	1,517
6	2.70	557	2.60	700	2.60	764	2.30	970	2.90	1,286	3.50	1,568
7	2.70	558	2.60	700	2.60	766	2.30	981	2.60	1,189	3.50	1,568
8	2.70	558	2.70	698	2.70	772	2.30	992	2.90	1,286	3.60	1,622
9	2.70	558	2.70	700	2.50	778	2.30	1,000	2.90	1,286	3.50	1,582*s*
10	2.70	558	2.70	703	2.60	780	2.30	1,010	3.00	1,326	3.50	1,586
11	2.70	558	2.70	715	2.50	780	2.30	1,017	3.10	1,370	3.50	1,590
12	2.70	558	2.70	727	2.50	778	2.30	1,019	3.20	1,417	3.60	1,646
13	2.70	560	2.60	736	2.70	776	2.20	1,020	3.10	1,370	3.60	1,654
14	2.70	560	2.60	740	2.60	773	2.30	1,016	3.10	1,370	3.50	1,604
15	2.70	564	2.70	744	2.50	763	2.30	1,016	3.20	1,417	3.60	1,662
16	2.70	572	2.70	744	2.50	770	2.20	985	3.10	1,370	3.50	1,616
17	2.70	590	2.70	744	2.60	778	2.20	989	3.10	1,370	3.50	1,620
18	2.70	618	2.60	744	2.60	785	2.30	1,000	3.10	1,370	3.20	1,464
19	2.70	656	2.70	750	2.60	795	2.30	1,040	3.10	1,370	3.20	1,468
20	2.80	676	2.70	756	2.60	799	2.30	1,110	3.40	1,517	3.50	1,628
21	2.70	688	2.70	764	2.60	804	2.40*b*	1,160	3.30	1,467	3.40	1,580
22	2.70	696	2.60	768	2.60	814	2.50	1,165	3.30	1,467	3.30	1,534
23	2.70	696	2.60	750	2.60	820	2.50	1,165	3.30	1,467	3.30	1,538
24	2.60	685	2.60	747	2.60	827	2.50	1,165	3.30	1,467	3.30	1,541
25	2.60	650	2.60	750	2.50	836	2.40	1,142	3.30	1,467	3.40	1,593
26	2.60	640	2.60	746	2.60	844	2.60	1,189	3.30	1,467	3.40	1,598
27	2.60	640	2.50	740	2.50	852	2.70	1,217	3.30	1,467	3.30	1,550
28	2.60	644	2.60	740	2.50	865	2.80	1,249	3.30	1,467	3.30	1,553
29	2.70	660	2.60	743	2.40	877	2.70	1,217	3.30	1,467	3.40	1,600
30	2.60	660	.....	.....	2.40	888	2.70	1,217	3.30	1,467	3.40	1,592 *s*
31	2.60	648	.....	.....	2.40	902	.....	.....	3.55	1,595	.....	.....

b Ice conditions from January 1 to April 21.
s Shifting conditions from June 9 to June 30.

DAILY GAUGE HEIGHT AND DISCHARGE of Lesser Slave river at Sawridge, for 1916—*Concluded*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.40	1,583*s*	3.90	1,786	2.90	1,246	2.80	1,152	2.90	1,200	2.40	745
2	3.40	1,572	3.90	1,785	3.00	1,286	2.70	1,122	2.00	1,040	2.30	745
3	3.40	1,562	3.90	1,784	3.00	1,283	2.80	1,146	2.40	1,110	2.20	748
4	3.95	1,850	3.90	1,783	3.20	1,362	2.70	1,116	2.60	1,165	2.50	750
5	3.70	1,695	3.90	1,782	3.10	1,320	2.70	1,112	2.50	1,150*s*	2.40	752
6	3.70	1,685	3.90	1,781	3.10	1,315	2.80	1,124	2.60	1,188	2.40	756
7	3.70	1,672	3.90	1,780	3.10	1,310	2.70	1,092	2.50	1,170	2.40	758
8	3.70	1,658	4.20	1,960	3.30	1,395	2.70	1,090	2.50	1,160	2.50	756
9	3.80	1,700	4.20	1,958	3.40	1,440	2.70	1,088	2.40	1,190	2.50	750
10	4.10	1,810	4.10	1,900	3.70	1,590	2.70	1,086	2.50	1,165	2.30	742
11	3.70	1,618	3.80	1,716	3.30	1,390	2.60	1,066	2.00	1,162	2.30	735
12	3.60	1,550	3.50	1,548	3.30	1,385	2.60	1,064	1.50*b*	1,020	2.20	730
13	4.30	1,940	3.50	1,546	3.20	1,340	2.80	1,080	2.00	1,060	2.30	727
14	4.10	1,806	4.00	1,830	3.10	1,288	2.60	1,048	2.00	1,060	2.30	730
15	3.80	1,620	3.60	1,600	3.10	1,285	2.60	1,040	2.20	970	2.40	746
16	3.80	1,630	3.50	1,542	3.10	1,280	2.50	1,020	2.10	890	2.40	753
17	3.90	1,690	3.80	1,710	3.00	1,240	2.70	1,035	2.20	800	2.30	760
18	4.00	1,760	3.60	1,590	3.00	1,236	2.60	1,025	2.20	760	2.30	750
19	4.10	1,825	3.60	1,588	3.80	1,598	2.80	1,036	2.60	750	2.40	730
20	4.20	1,900	3.50	1,536	2.90	1,204	2.60	1,026	2.30	744	2.40	718
21	4.20	1,910	3.50	1,535	2.80	1,182	2.80	1,044	2.30	740	2.40	708
22	4.10	1,850	3.50	1,533	2.80	1,178	2.60	1,032	2.50	740	2.30	672
23	3.90	1,750	3.40	1,486	2.70	1,152	2.80	1,070	2.40	740	2.30	664
24	3.90	1,758	3.40	1,485	2.70	1,150	2.60	1,040	2.40	740	2.30	664
25	3.90	1,765	3.40	1,483	2.70	1,148	2.60	1,046	2.40	740	2.30	664
26	3.90	1,772	3.30	1,420	3.50	1,410	2.60	1,053	2.40	745	2.30	662
27	3.90	1,780	3.30	1,418	2.90	1,182	3.00	1,164	2.40	745	2.30	656
28	4.00	1,850	3.30	1,416	2.80	1,162	2.50	1,072	2.50	745	2.30	650
29	3.90	1,792	3.40	1,466	2.80	1,160	2.40	1,060	2.40	745	2.30	655
30	3.90	1,790	3.30	1,412	2.80	1,156	2.70	1,136	2.50	745	2.30	664
31	3.70	1,670	3.20	1,370	.....	.....	2.80	1,166	.....	.....	2.30*b*	670

b Ice conditions, November 12 to December 31.
s Shifting conditions, July 1 to November 5.

MONTHLY DISCHARGE of Lesser Slave river at Sawridge, for 1916

(Drainage area 5932 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	696	557	607	0.102	0.12	37,323
February	768	646	724	0.122	0.13	41,645
March	902	752	799	0.135	0.16	49,129
April	1,249	916	1,058	0.178	0.20	62,955
May	1,595	1,189	1,384	0.233	0.27	85,099
June	1,662	1,464	1,575	0.265	0.30	93,719
July	1,940	1,550	1,736	0.293	0.34	106,743
August	1,960	1,370	1,630	0.275	0.32	100,225
September	1,598	1,148	1,289	0.217	0.24	76,701
October	1,166	1,020	1,079	0.182	0.21	66,345
November	1,200	740	939	0.158	0.18	55,874
December	760	650	716	0.121	0.14	44,025
The year	.....	.....	.....	.....	2.61	819,773

ATHABASKA RIVER AT ATHABASKA

Location.—On the SE. ¼ Sec. 20, Tp. 66, Rge. 22, W. 4th Mer., 400 feet above the ferry cable in the town of Athabaska.

Records available.—March 17, 1914, to December 31, 1916, and discharge measurements during the winters of 1912-13 and 1913-14.

Drainage area.—29,643 square miles; taken from latest available maps which are of small scale and liable to error.

Gauge.—Inclined staff, located on left bank of river, 300 feet above ferry cable and 100 feet below measuring section; zero elevation of gauge maintained at 1,635.38 feet since establishment.

Bench-marks.—Permanent iron bench-mark at foot of ferry cable tower on left bank of river; elevation 1,658.00 feet. Bench-mark on window sill of Grand Union hotel on right bank; elevation 1,668.90 feet.

These elevations are above mean sea-level; Canadian Northern railway datum.

Channel.—One, slightly shifting channel at all stages.

Discharge measurements.—Made from a boat run on a cable.

Winter flow.—Stream affected by ice from November to April.

Observer.—R. Vance.

DISCHARGE MEASUREMENTS of Athabaska river at Athabaska, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 10	C. M. O'Neil	830	2,198	1.12	3.31	2,552
Feb. 11	do	667	2,442	0.94	3.17	2,285
Mar. 8	do	665	2,385	1.00	3.30	2,378
April 4	do	645	2,666	0.86	3.90	3,093
May 4	do	693	5,175	2.79	5.00	14,420
May 27	H. S. Kerby	692	4,797	2.38	4.16	11,411
June 20	do	816	8,274	4.25	8.60	35,164*x*
June 20	do	816	8,460	4.46	8.82	37,754
June 21	do	825	9,089	4.86	9.58	44,200
June 22	do	813	10,351	5.68	11.10	58,780
June 22	do	813	9,733	5.15	10.35	50,125*x*
June 23	do	817	11,308	5.79	12.25	65,473*x*
July 12	do	835	10,224	5.38	11.01	55,000
Aug. 4	do	801	7,430	3.78	7.55	28,085*x*
Aug. 24	do	728	5,728	2.97	5.62	16,997
Sept. 12	do	745	5,972	3.05	5.88	18,233
Oct. 5	W. T. Reeve	690	4,402	2.24	3.73	9,877
Dec. 2	C. McGavin	726	3,115	0.96	3.40	3,001
Dec. 23	do	680	2,745	1.07	3.31	2,936

x Slope measurement.

DAILY GAUGE HEIGHT AND DISCHARGE of Athabaska river at Athabaska, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.61*b*	2,830	3.14	2,270	3.49	2,980	3.84	3,000	6.25	20,375	4.42	12,272
2	3.66	2,740	3.14	2 240	3.49	2,930	3.89	3,080	5.18	15,256	4.82	13,780
3	3.66	2,695	3.09	2 240	3.54	2,940	3.94	3,100	5.04	14,668	4.92	14,180
4	3.71	2.500	3.14	2,355	3.49	2,930	3.91	3,093	5.00	14,500	5.70	17,600
5	3.61	2,600	3.14	2,370	3.39	2,700	3.91	3,130	5.80	18,100	5.49	16,605
6	3.56	2,575	3.14	2,350	3.29	2,300	3.91	3,145	6.23	20.265	5.25	15,555
7	3.51	2.570	3.14	2.350	3.33	2,315	3.95	3,155	6.21	20,155	5.68	17,500
8	3.51	2,560	3.14	2.340	3.33	2,378	4.00	3,200	6.14	19,800	5.98	19,000
9	3.46	2.560	3.19	2,285	3.33	2,400	4.30	3,300	6.06	19.400	6.18	20,000
10	3.36	2,552	3.14	2,280	3.28	2,365	4.30	3,370	5.81	18,150	5.52	16,740
11	3.27	2,600	3.15	2,285	3.28	2,300	4.40	3,415	5.55	16,875	5.32	15,856
12	3.37	2,640	3.15	2,280	3.28	2,275	4.40	3,470	5.23	15,469	5.22	15,426
13	3.37	2,695	3.15	2,300	3.33	2,330	4.50	3,515	4.84	13,860	5.26	15,596
14	3.32	2,720	3.20	2,350	3.38	2,445	4.50	3,615	4.60	12,920	5.35	15,985
15	3.32	2,740	3.20	2,430	3.38	2,500	4.60	3,690	4.35	12,025	5.24	15,512
16	3.27	2,760	3.20	2,500	3.43	2,530	4.60	3,740	4.18	11,430	5.15	15,130
17	3.27	2,810	3.20	2,515	3.43	2,600	4.70	3,825	4.04	10,940	5.28	15,684
18	3.27	2,890	3.20	2,520	3.48	2,680	4.80	3,915	3.89	10,415	6.32	20,760
19	3.22	2,930	3.20	2,525	3.48	2,720	4.80	4,000	3.75	9,950	7.75	29,660
20	3.22	3,000	3.20	2,500	3.48	2,735	4.90	4,130	3.72	9,860	8.75	36,825
21	3.22	3,020	3.20	2,500	3.44	2,740	5.00	4,390	3.70	9,800	9.48	42,370
22	3.23	3,000	3.20	2,550	3.44	2,730	8.67	12,000	3.74	9,920	10.55	51,085
23	3.23	2,850	3.34	2,700	3.44	2,725	7.86	13,200	3.91	10,485	12.14	64,504
24	3.23	2,680	3.49	2,900	3.44	2,700	6.48	15,000	4.16	11,360	12.60	63,300
25	3.28	2,470	3.59	3,100	3.44	2,695	8.67	17,000	4.39	12,165	10.38	49,676
26	3.28	2.385	3.59	3,120	3.44	2,700	7.18	16,400	4.35	12,025	9.75	44,510
27	3.38	2,380	3.54	3,070	3.49	2,690	6.96	18,000	4.15	11,325	9.35	41,363
28	3.38	2,340	3.54	3,060	3.49	2,700	6.94	18,000	4.04	10,940	9.05	39,075
29	3.28	2,325	3.54	3,055	3.74	2,750	6.62	18,200	3.95	10,625	8.95	38,325
30	3 23	2,300	.....	.....	3.79	2,830	6.37*b*	20,000	4.02	10,870	9.02	38,850
31	3.23	2,290	.....	.....	3.84	2,920	.....	.....	4.10	11,150	.....	.....

b Ice conditions from January 1 to April 30.

DAILY GAUGE HEIGHT AND DISCHARGE of Athabaska river at Athabaska, for 1916—*Concluded*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1....	9.30	40,975	8.47	34,725	5.84	18,300	3.90	10,450	3.73	9,890	3.57	3,030
2....	9.15	39,825	8.21	32,870	5.84	18,300	3.84	10,240	3.57	9,410	3.55	3,000
3....	8.75	36,825	7.94	30,980	5.87	18,450	3.75	9,950	3.26	8,480	3.40	2,970
4....	8.40	34,200	7.50	27,970	5.95	18,850	3.71	9,830	3.21	8,330	3.39	2,960
5....	8.52	35,100	7.57	28,439	6.12	19,700	3.71	9,830	3.13	8,090	3.33	2,970
6....	11.32	57,520	7.66	29,048	6.40	21,200	3.70	9,800	3.10	8,000	3.32	2,970
7....	13.20	73,620	7.73	29,524	6.48	21,640	3.61	9,530	3.05	7,850	3.30	2,940
8....	12.80	70,180	7.56	28,372	6.39	21,145	3.55	9,350	3.00	7,700	2.97	2,920
9....	12.15	64,590	7.14	25,622	6.45	21,475	3.48	9,140	3.00	7,700	3.05	2,890
10....	11.40	58,200	6.92	24,244	6.38	21,090	3.40	8,900	2.89	7,370	3.24	2,880
11....	11.08	55,492	6.90	24,120	6.03	19,250	3.39	8,870	2.84	7,220	3.23	2,890
12....	10.99	54,737	7.00	24,740	5.94	18,800	3.37	8,810	2.79	7,075	3.20	2,900
13....	11.21	56,585	7.14	25,622	5.82	18,200	3.33	8,690	3.39[b]	6,500	3.05	2,940
14....	11.16	56,164	6.80	23,500	5.50	16,650	3.23	8,390	3.49	5,800	3.02	2,950
15....	10.99	54,737	6.46	21,530	5.28	15,684	3.17	8,210	3.59	5,250	3.00	2,950
16....	10.93	54,239	6.17	19,950	5.03	14,626	3.17	8,210	3.79	4,950	2.94	2,940
17....	10.76	52,828	6.08	19,500	4.88	14,020	3.19	8,270	4.13	4,750	2.74	2,900
18....	9.99	46,478	6.19	20,050	4.68	13,232	3.16	8,180	3.88	4,625	2.59	2,900
19....	9.27	40,742	6.48	21,640	4.50	12,560	3.34	8,720	3.89	4,530	2.94	2,900
20....	9.30	40,975	6.70	22,900	4.35	12,025	3.53	9,290	3.90	4,420	3.14	2,900
21....	9.50	42,525	6.54	21,970	4.22	11,570	4.48	12,488	3.85	4,290	3.19	2,930
22....	9.22	40,355	5.98	19,000	4.19	11,465	4.95	14,300	4.02	4,130	3.39	2,930
23....	8.62	35,850	5.80	18,100	4.12	11,220	4.63	13,037	4.00	3,980	3.34	2,940
24....	8.38	34,060	5.60	17,100	4.12	11,220	4.41	12,236	3.99	3,830	3.19	2,920
25....	8.07	31,890	5.42	16,290	3.99	10,765	4.31	11,885	3.94	3,650	3.34	2,900
26....	7.68	29,184	5.40	16,200	3.93	10,555	4.27	11,745	3.90	3,500	3.30	2,910
27....	7.38	27,170	5.66	17,400	3.97	10,695	4.22	11,570	3.88	3,370	3.33	2,920
28....	7.19	25,937	5.92	18,700	4.01	10,835	4.14	11,290	4.00	3,270	3.34	2,920
29....	7.69	29,252	5.99	19,850	4.00	10,800	4.04	10,940	3.80	3,170	3.33	2,920
30....	8.92	38,100	5.90	18,600	3.98	10,730	3.90	10,450	3.79	3,100	3.31	2,920
31....	8.86	37,650	5.89	18,550	.....	.....	3.81	10,135	.....	.....	3.32[b]	2,900

[b] Ice conditions from November 13 to December 31.

MONTHLY DISCHARGE of Athabaska river at Athabaska, for 1916

(Drainage area 29,643 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	3,020	2,290	2,645	0.089	0.10	162,634
February	3,120	2,240	2,529	0.085	0.09	145,482
March	2,980	2,275	2,630	0.089	0.10	161,712
April	20,000	3,000	7,369	0.249	0.28	438,486
May	20,375	9,800	13,712	0.463	0.53	843,118
June	64,504	12,272	27,757	0.936	1.04	1,651,657
July	73,620	25,937	45,032	1.519	1.75	2,768,910
August	34,725	16,200	23,132	0.780	0.90	1,422,331
September	21,640	10,555	15,502	0.523	0.58	922,433
October	14,300	8,180	10,088	0.340	0.39	620,287
November	9,890	3,100	5,808	0.196	0.22	345,600
December	3,030	2,880	2,929	0.099	0.11	180,097
The year	.....	.....	.....	.....	6.09	9,662,747

MISCELLANEOUS DISCHARGE MEASUREMENTS made in Athabaska River Drainage Basin, in 1916

Date	Engineer	Stream	Location	Width	Area of Section	Mean Velocity	Discharge
				Feet	*Sq. Feet*	*Feet per sec.*	*Sec.-Feet*
Jan. 7	R. J. McGuinness	Embarras river	SW. 5-52-18-5	70.0	108.00	0.22	23.00
Feb. 24	do	do	do	40.0	22.50	0.54	12.20
Mar. 22	do	do	do	70.0	56.00	1.20	67.00
April 7	do	do	do	185.0	297.00	2.61	776.00
April 25	do	do	do	112.0	182.80	0.90	165.00*x*
May 19	C. McGavin	do	do	122.0	175.10	1.04	183.00
June 12	do	do	do	195.0	236.70	2.98	707.00
June 21	do	do	do	178.0	867.80	2.31	2006.00*x*
July 2	do	do	do	141.0	328.00	2.29	754.00
July 24	do	do	do	127.0	203.80	2.10	428.00*x*
Aug. 12	do	do	do	125.0	212.95	1.92	409.00
Sept. 3	W. T. Reeve	do	do	174.0	165.00	2.64	436.00
Sept. 27	do	do	do	129.0	95.85	2.19	211.00
Oct. 25	do	do	do	160.0	137.40	2.73	375.00
May 15	C. McGavin	Fiddle river	SE. 15-49-27-5	32.0	21.30	2.02	43.00
Aug. 7	do	do	do	48.0	47.40	3.02	143.00
June 8	do	Happy creek	SE. 14-51-25-5	6.0	2.95	0.57	1.69
Sept. 2	W. T. Reeve	do	do	6.5	3.35	0.65	2.20
June 8	C. McGavin	Hardisty creek	SE. 24-51-25-5	8.5	6.20	0.60	3.80
July 18	do	do	do	13.5	14.22	1.03	14.70
Sept. 1	W. T. Reeve	do	do	12.0	5.95	0.80	4.80
Sept. 22	do	do	do	9.5	3.35	0.40	1.41
Aug. 1	P. H. Daniells	Heart river	SW. 31-75-16-5	62.0	272.00	1.23	335.00
Sept. 17	W. T. Reeve	Maligne river	Above gorge	45.0	34.00	1.93	66.00
Aug. 11	C. McGavin	Muskeg creek	SW. 15-54-16-5	67.0	67.25	0.66	44.00
Oct. 6	W. T. Reeve	do	NW. 17-66-22-4	15.0	14.60	0.24	6.20
Dec. 4	C. McGavin	do	do	12.0	1.92	0.23	0.44
May 13	do	Prairie creek	SE. 5-51-25-5	32.0	17.40	1.04	18.10
June 7	do	do	do	45.0	37.00	1.55	58.00
June 28	do	do	do	51.0	47.00	2.21	104.00
July 18	do	do	do	41.0	37.80	1.23	47.00
Aug. 9	do	do	do	45.0	45.75	1.66	76.00
Sept. 1	W. T. Reeve	do	do	37.0	29.65	0.95	28.00
Sept. 22	do	do	do	33.0	24.90	0.76	18.70
Oct. 22	do	do	do	35.0	28.20	0.86	24.00
June 10	P. H. Daniells	East Prairie river	SW. 11-74-16-5	73.0	152.00	1.40	212.00
Aug. 3	do	do	do	74.0	204.00	1.11	227.00
June 9	do	West Prairie river	SW. 14-74-17-5	74.0	79.90	1.42	114.00
June 27	do	do	do	75.0	42.00	0.93	39.00
Mar. 31	R. J. McGuinness	Snaring river	NW. 33-46-1-6	15.0	8.50	0.37	3.10
April 17	do	do	do	22.0	21.50	2.49	54.00
May 11	C. McGavin	do	do	84.0	118.40	3.49	414.00
June 3	do	do	do	163.0	249.60	3.55	886.00
June 20	do	do	do	246.0	590.60	9.10	5374.00*x*
June 25	do	do	do	246.0	532.00	6.94	3692.00*x*
July 16	do	do	do	246.0	493.00	6.47	3190.00*x*
Aug. 6	do	do	do	138.0	207.30	3.89	807.00
Aug. 25	do	do	do	125.0	194.00	3.30	641.00
Sept. 19	W. T. Reeve	do	do	106.0	109.90	2.93	322.00
Oct. 18	do	do	do	93.0	149.60	5.33	798.00
May 19	C. McGavin	Sundance creek	SW. 3-53-18-5	20.0	21.50	1.56	33.00
June 12	do	do	do	36.0	33.25	1.13	38.00
July 2	do	do	do	25.0	19.00	1.93	37.00
July 24	do	do	do	36.0	34.90	0.88	31.00
Aug. 12	do	do	do	31.0	22.80	1.77	40.00
Oct. 24	W. T. Reeve	do	do	37.0	32.10	1.31	41.00
Oct. 6	do	Tawatinaw creek	SE. 19-66-22-4	24.0	28.20	0.70	19.70
Dec. 4	C. McGavin	do	do	43.7	9.65	0.89	8.60
May 17	do	Wolf creek	SW. 3-54-16-5	80.5	91.17	1.10	101.00
July 1	do	do	do	85.6	101.79	2.02	205.00
Aug. 11	do	do	do	71.0	64.90	1.26	82.00
Sept. 4	W. T. Reeve	do	do	76.0	82.50	1.19	98.00
Sept. 25	do	do	do	73.0	62.70	0.77	49.00

x Slope measurement.

NORTH SASKATCHEWAN RIVER DRAINAGE BASIN

General Description

The North Saskatchewan river draws its principal water supply from the eastern slope of the Rocky mountains. The basin is bounded on the south by those of the Red Deer and South Saskatchewan rivers and on the north by those of the Athabaska and Churchill rivers. The general trend of the stream from its source to where it joins the South Saskatchewan, a few miles below the city of Prince Albert, and forms the Saskatchewan river, is easterly.

The basin of the river easily divides itself into five parts or divisions, each of which requires a separate description for a clear understanding of the conditions of run-off.

The first, or upper section, consists of the eastern slope of the Rocky mountains. While this part of the basin is not the greatest area, it supplies the greater part of the run-off. In glaciers and the perpetual snows of the higher peaks, innumerable small streams rise which form the main stream and its larger tributaries. These streams have well-defined rocky valleys and considerable fall. The upper regions of this section are not well wooded, and allow a rapid run-off of melting snow and rain.

East of this first section is a division consisting of the foot-hills, which are, for the most part, well covered with forest and vegetable growth, forming probably the largest area of the five sections. Here also is a very large source of supply for the stream, but due to its cover, a more regulated supply than in the first section. In this section the main stream is joined by the Clearwater and Brazeau rivers, two of the most important tributaries of the whole basin. The streams in this section flow through deep valleys with fairly permanent beds and medium slopes.

From a little west of the city of Edmonton to the mouth of the Vermilion river the country is of a parklike nature with large stretches of prairie. This section is small in area and has not a very large run-off. The principal tributaries are the Sturgeon and Vermilion rivers, the first of which drains in from the wooded country of the north, the latter from the prairie section of the south. The main stream is in a well defined valley with large flats along its course and a more or less permanent bed with a small slope.

Below the third section to a little above the city of Prince Albert is a division which has little drainage into the river. It consists of prairie uplands for the most part, with small patches of timber to the north. The stream widens out into shallow reaches, full of shifting sand bars and has very little slope. The valley, while still well defined, is also much wider. In this section the main stream is fed by the Battle river, which has its source at the outlet of Battle lake, and flows eastward through park land and prairie sections south of the main river, until it empties into the latter at the town of Battleford.

The east division is one in which the river with a greater slope and more permanent bed, narrows considerably, as does also the valley. The run-off in this division is mostly from the north, which consists of well wooded country drained by a number of small streams.

Reports of floods in this basin may be found on pages 30 and 31 of the Report of the Progress of Stream Measurements for 1912, and Appendix No. 4 of the 1915 report.

MISTAYA RIVER NEAR MOUTH OF STREAM

Location.—Sec. 33, Tp. 34, Rge. 20, W. 5th Mer., and about one-quarter mile above mouth of stream.

Records available.—Discharge measurements during open water seasons of 1915 and 1916.

Gauge.—None established.

Bench-mark.—Standard wooden, located on left bank about 250 feet above cable; assumed elevation 100.00 feet.

Channel.—The banks are fairly permanent but the bed, consisting of gravel and boulders, is liable to washout and refill during floods.

Daily measurements.—Made from a cable throughout 1916.

Winter flow.—Stream affected by ice from November to May.

Floods.—During the high water of June, 1916, the gravel bar in centre of channel at section was washed out. There were no indications of the banks overflowing during the entire season 1916. The elevation of high water-mark for the season was 96.00 feet relative to bench-mark.

Observer.—None available.

DISCHARGE MEASUREMENTS of Mistaya river near mouth of stream, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq.ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
July 3	C. M. O'Neil	50.0	137.0	6.55	95.86*x*	898
Aug. 3	do	52.0	143.0	6.79	95.90*x*	972
Oct. 20	do	40.5	69.0	3.78	94.85*x*	263

x Water surface elevation referred to bench-mark.

SIFFLEUR RIVER NEAR WILSON'S RANCH

Location.—Tp. 35, Rge. 17, W. 5th Mer., about three miles south of the Wilson Ranger cabin and one and one-half miles above the mouth of the stream.

Records available.—Gauge heights May 17 to May 29, 1915. Discharge measurements during the open water seasons 1915 and 1916.

Gauge.—Vertical staff; zero maintained at 89.18' feet during 1915. New gauge section used for water surface elevation in 1916 and no gauge installed.

Bench-mark.—Standard wooden, located on the left bank about twenty-five feet down stream from cable; assumed elevation 100.00 feet.

Channel.—Permanent, consisting of rock banks and gravel bed.

Discharge measurements.—Made from a cable and by wading.

Winter flow.—Stream affected by ice from November to May.

Floods.—On June 29, 1916, the stream was at its maximum stage. The water surface elevation was 89.54 feet, which is one foot above normal and the corresponding discharge measured was 1,543 sec.-ft.

Observer.—None available.

DISCHARGE MEASUREMENTS of Siffleur river near Wilson's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
May 9	O. H. Hoover	54.7	97.1	1.34	87.71*x*	130
May 15	do	53.0	88.8	1.17	87.64*x*	104
June 29	C. M. O'Neil	55.0	232.0	6.65	89.54*x*	1,543
July 5	do	55.0	228.0	6.01	89.35*x*	1,371
Aug. 1	do	54.7	199.0	5.01	88.93*x*	996
Aug. 5	do	55.0	192.0	4.78	88.78*x*	920
Sept. 16	do	52.0	140.0	2.56	88.10*x*	359
Oct. 18	do	52.5	137.0	2.24	88.07*x*	307
Oct. 21	do	52.5	135.0	1.95	87.93*x*	263

x Water surface elevation referred to bench-mark.

NORTH SASKATCHEWAN RIVER AT WILSON'S RANCH

Location.—Sec. 23, Tp. 36, Rge. 18, W. 5th Mer., and about one-half mile southwest of the Wilson Forest Ranger cabin.

Records available.—Discharge measurements May 18 to October 29, 1915, and from March 22 to October 23, 1916. Gauge heights May 15 to May 31, 1915, and from June 17 to October 23, 1916.

Gauge.—Stevens continuous water stage recorder; elevation of zero maintained at 85.13 feet. Staff for checking purposes maintained at same datum.

Bench-mark.—Standard wooden, located on the right bank two hundred and twenty feet below cable; assumed elevation 100.00 feet.

Channel.—Well defined and fairly permanent, consisting of sand, gravel and boulders.

Discharge measurements.—Made from a cable.

Winter flow.—During normal seasons the stream is affected by ice from early in November to May.

Floods.—On June 19, 1916, a maximum gauge height of 10.34 feet was reached, but owing to the low temperatures at night no abnormal flooding occurred and very little debris was moved.

Accuracy.—The daily discharges computed from June 17 to October 23, 1916, are based upon the mean daily gauge heights taken from the continuous record of an automatic gauge and are well within the required degree of accuracy. The open water discharge curve passes through eight out of ten points plotted from ten measurements throughout the season, the other two points plot very close to the curve. The daily discharges computed and estimated for the eight months, not included in above period, are based upon discharge measurements and temperature graphs; also upon the daily discharge at Saunders, ninety miles down stream, where records have been observed to correspond closely throughout the year. These discharges are therefore only fair estimates.

DISCHARGE MEASUREMENTS of North Saskatchewan river at Wilson's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 22	O. H. Hoover	170.0	222	1.15	6.17	256*i*
May 8	do	180.0	432	2.60	4.33	1,123
May 16	do	174.0	330	2.18	3.76	719
June 22	C. M. O'Neil	206.0	1,425	6.49	8.76	9,241
June 29	do	204.0	1,363	6.08	8.45	8,287
July 5	do	200.0	1,114	5.65	7.75	6,289
July 5	do	200.0	1,114	5.65	7.75	6,289*x*
July 31	do	201.0	1,054	5.25	7.29	5,530
July 31	do	201.0	1,054	5.25	7.29	5,530*x*
Aug. 7	do	202.5	1,098	5.40	7.52	5,928
Sept. 15	do	190.0	639	3.53	5.33	2,255
Oct. 17	do	195.0	882	4.65	6.38	4,104
Oct. 23	do	192.0	520	2.81	4.67	1,464

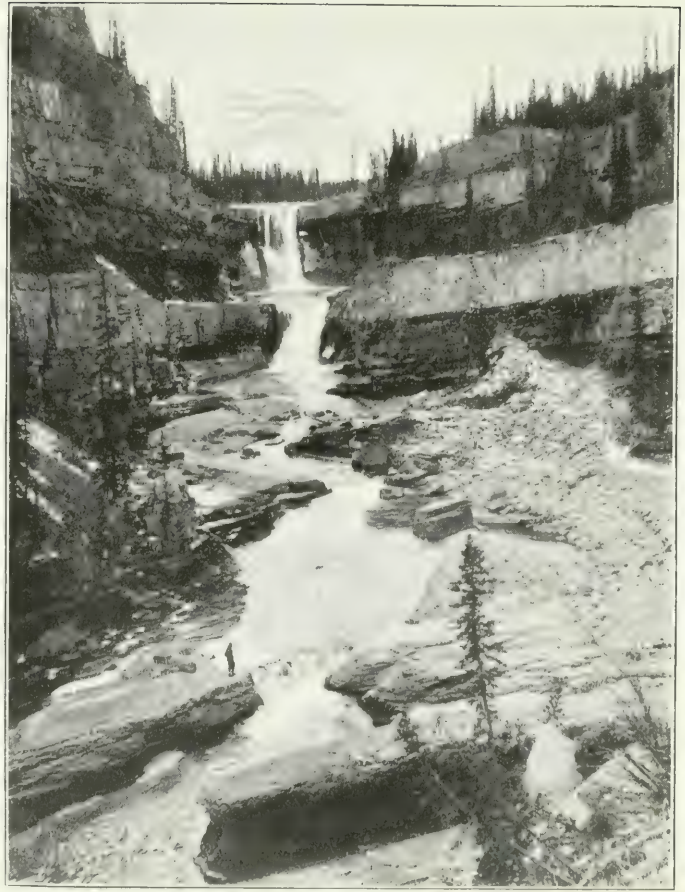
i Stream frozen over.
x Slope measurement.

DAILY GAUGE HEIGHT AND DISCHARGE of North Saskatchewan river at Wilson's ranch, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	326*b*	.....	228	.....	267	.....	316	.....	710	.....	1,480*e*
2	.....	325	.....	220	.....	267	.....	320	.....	765	.....	1,510*e*
3	.....	323	.....	214	.....	266	.....	324	.....	834	.....	1,620*e*
4	.....	320	.....	212	.....	262	.....	330	.....	914	.....	1,670*e*
5	.....	320	.....	212	.....	258	.....	334	.....	1,090	.....	1,840*e*
6	.....	320	.....	212	.....	256	.....	338	.....	1,118	.....	1,920*e*
7	.....	320	.....	210	.....	255	.....	340	.....	1,122	.....	2,000*e*
8	.....	320	.....	210	.....	253	.....	344	4.33	1,123	.....	2,200*e*
9	.....	318	.....	210	.....	250	.....	350	.....	1,122	.....	2,600*e*
10	.....	316	.....	210	.....	248	.....	354	.....	1,120	.....	3,200*e*
11	.....	316	.....	210	.....	244	.....	360	.....	1,090	.....	4,000*e*
12	.....	312	.....	210	.....	240	.....	364	.....	1,000	.....	4,300*e*
13	.....	304	.....	208	.....	240	.....	370	.....	910	.....	5,000*e*
14	.....	294	.....	210	.....	240	.....	376	.....	840	.....	8,060*e*
15	.....	285	.....	212	.....	240	.....	380	.....	765	.....	9,100*e*
16	.....	270	.....	218	.....	240	.....	386	.....	719	.....	11,200*e*
17	.....	262	.....	222	.....	240	.....	393	.....	720*e*	9.45	12,250
18	.....	258	.....	228	.....	242	.....	400	.....	700*e*	10.24	16,544
19	.....	256	.....	234	.....	244	.....	410	.....	710*e*	10.34	17,704
20	.....	258	.....	240	.....	248	.....	422*b*	.....	720*e*	10.12	15,872
21	.....	258	.....	248	.....	252	.....	436	.....	720*e*	9.64	13,256
22	.....	260	.....	256	6.17	256*d*	.....	450	.....	730*e*	8.76	9,286
23	.....	260	.....	262	.....	262	.....	467	.....	745*e*	8.23	7,644
24	.....	260	.....	266	.....	270	.....	484	.....	760*e*	8.03	7,084
25	.....	260	.....	268	.....	275	.....	504	.....	780*e*	8.23	7,644
26	.....	256	.....	268	.....	282	.....	527	.....	800*e*	8.48	8,344
27	.....	254	.....	268	.....	288	.....	558	.....	920*e*	8.56	8,604
28	.....	254	.....	268	.....	294	.....	590	.....	1,040*e*	8.75	9,250
29	.....	250	.....	268	.....	302	.....	628	.....	1,200*e*	8.63	8,842
30	.....	248	.....	.....	.....	306	.....	660	.....	1,380*e*	7.96	6,906
31	.....	238	.....	.....	.....	312	.....	.....	.....	1,460*e*	.....	.....

b Ice conditions from January 1 to April 20.
d Actual measurement.
e Discharge estimated.

PLATE 5



Falls on Bighorn river near Nordegg, Alberta. Taken on October 26, 1916, by C. M. O'Neil.

PLATE 6

Shelter for automatic gauge on North Saskatchewan river at Wilson's ranch, made almost entirely of poles cut at the site. Taken on September 17, 1916, by C. M. O'Neil.

DAILY GAUGE HEIGHT AND DISCHARGE of North Saskatchewan river at Wilson's ranch, for 1916.—*Concluded.*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	7.81	6,544	7.70	6,280	7.92	6,808	4.63	1,430	.....	840*b*	.....	398
2	8.12	7,336	7.90	6,760	8.30	7,840	4.50	1,300	.....	810	.....	386
3	8.23	7,644	8.05	7,140	8.11	7,308	4.38	1,202	.....	770	.....	374
4	8.28	7,784	7.57	5,968	7.85	6,640	4.25	1,095	.....	740	.....	362
5	7.72	6,328	7.42	5,640	7.78	6,472	4.28	1,120	.....	700	.....	345
6	7.44	5,680	7.42	5,640	7.28	5,360	4.25	1,095	.....	660	.....	340
7	7.70	6,280	7.62	6,088	6.87	4,566	4.10	972	.....	630	.....	340
8	8.88	9,712	7.87	6,688	6.85	4,530	3.95	856	.....	605	.....	342
9	9.31	11,550	7.81	6,544	6.68	4,224	3.87	802	.....	584	.....	342
10	9.50	12,500	7.49	5,780	6.22	3,452	3.81	760	.....	560	.....	340
11	9.32	11,600	7.26	5,320	6.04	3,164	3.78	740	.....	530	.....	338
12	9.45	12,250	7.25	5,300	6.07	3,212	3.78	740	.....	508	.....	336
13	10.07	15,592	7.46	5,720	5.83	2,862	3.79	747	.....	490	.....	334
14	9.18	10,942	7.75	6,400	5.56	2,484	4.07	946	.....	480	.....	333
15	8.32	17,896	7.84	6,616	5.48	3,376	4.40	1,218	.....	470	.....	332
16	8.46	8,288	7.58	5,992	5.45	2,340	5.07	1,884	.....	467	.....	332
17	9.38	11,900	7.08	4,960	5.51	2,414	6.19	3,404	.....	464	.....	331
18	9.44	12,200	6.83	4,494	5.58	2,512	5.90	2,960	.....	464	.....	331
19	8.46	8,288	6.43	3,788	5.64	2,596	5.54	2,456	.....	463	.....	331
20	7.93	6,832	6.23	3,468	5.58	2,512	5.23	2,076	.....	460	.....	331
21	7.44	5,680	6.17	3,372	5.37	2,244	5.01	1,812	.....	458	.....	332
22	7.14	5,080	6.60	4,080	5.43	2,316	4.80	1,600	.....	454	.....	330
23	6.92	4,656	7.37	5,540	5.48	3,376	4.70	1,500	.....	450	.....	330
24	6.72	4,296	7.75	6,400	5.48	3,376	.....	1,414*e*	.....	448	.....	330
25	7.02	4,840	7.73	6,352	5.57	2,498	.....	1,340*e*	.....	442	.....	328
26	7.38	5,560	7.72	6,328	5.32	2,184	.....	1,220*e*	.....	438	.....	324
27	7.48	5,760	7.70	6,280	5.01	1,812	.....	1,132*e*	.....	432	.....	324
28	7.36	5,520	7.70	6,280	4.80	1,600	.....	1,040*e*	.....	424	.....	326
29	7.07	4,940	7.72	6,328	4.68	1,480	.....	960*e*	.....	416	.....	332
30	7.08	4,960	7.73	6,352	4.71	1,510	.....	920*e*	.....	408	.....	340
31	7.29	5,380	7.90	6,760	.....	.....	.....	875*e*	.....	.....	.....	348*b*

b Ice conditions November 1 to December 31.
e Discharge estimated.
For accuracy of daily discharges, November and December, see Accuracy Notes in description of station.

MONTHLY DISCHARGE of North Saskatchewan river at Wilson's ranch, for 1916

(Drainage area 952 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	326	238	285	0.299	0.34	17,524
February	268	208	231	0.243	0.26	13,287
March	312	240	261	0.274	0.32	16,048
April	660	316	417	0.438	0.49	24,813
May	1,460	700	923	0.969	1.12	56,753
June	17,704	1,480	7,031	7.385	8.24	418,374
July	17,896	4,296	8,188	8.600	9.92	503,460
August	7,140	3,372	5,763	6.050	6.98	354,353
September	7,840	1,480	3,569	3.750	4.18	212,370
October	3,404	740	1,342	1.410	1.63	82,516
November	840	408	536	0.563	0.63	31,894
December	398	324	340	0.357	0.41	20,906
The year	.....	.....	.....	.....	34.52	1,752,298

WHITERABBIT CREEK AT WILSON'S RANCH

Location.—Tp. 36, Rge. 18, W. 5th Mer., about one-half mile northeast from the Wilson Forest Ranger cabin.

Records available.—Gauge heights May 16 to May 31, 1915. Discharge measurements during open water seasons 1915 and 1916.

Gauge.—None established during 1916.

Channel.—Shifting; consisting of sand and gravel.

Discharge measurements.—Made by wading or from a temporary cable.

Winter flow.—Stream affected by ice from November to May.

Floods.—The maximum flow during 1916 occurred about July 5, on which date the measured discharge was 250 sec.-ft.

Observer.—None available during 1916.

DISCHARGE MEASUREMENTS of Whiterabbit creek at Wilson's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
May 8	O. H. Hoover	13.0	6.40	1.97	.....	12.6
May 16	do	10.5	4.17	1.08	.....	4.5
June 29	C. M. O'Neil	44.0	37.4	4.26	.....	159.0
July 5	do	45.0	50.50	4.95	.....	250.0
July 31	do	21.5	15.70	2.54	.....	40.0
Aug. 7	do	24.0	19.60	3.13	.....	61.0
Sept. 16	do	17.5	12.60	2.00	.....	25.0
Oct. 17	do	19.0	10.40	2.79	.....	29.0
Oct. 22	do	18.0	7.91	2.02	.....	16.0

Water surface elevation of no value as stream changed its channel continually between measurements.

CLINE RIVER NEAR MOUTH OF STREAM

Location.—Tp. 37, Rge. 18, W. 5th Mer., about three miles above mouth of stream.

Records available.—Discharge measurements only during open water seasons 1915 and 1916.

Gauge.—None established.

Bench-mark.—Standard wooden; located on the left bank, 250 feet down stream from the cable; assumed elevation 100.00 feet.

Channel.—Shifting, consisting of rock, gravel and sand.

Discharge measurements.—Made from a cable or by wading.

Winter flow.—Stream affected by ice from November to May.

Floods.—During June, 1916, the stream was in flood, overflowing its banks about one mile below the cable station, but not at cable. The maximum elevation of the water surface was 89.18 feet relative to the bench-mark and the estimated discharge 6,657 sec.-ft.

Observer.—None available.

DISCHARGE MEASUREMENTS of Cline river near mouth of stream, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 21	O. H. Hoover	51.0	68.1	1.28	83.12*x*	87.0
Mar. 24	do	51.0	76.2	1.26	83.10*x*	96.0
May 7	do	64.5	96.4	2.96	84.15*x*	285.0
May 17	do	55.0	94.0	2.12	83.84*x*	199.0
June 16	C. M. O'Neil	82.0	555.0	12.00	89.18*x*	6,657.0*e*
July 6	do	76.0	146.2	7.06	84.98*x*	1,031.0
July 29	do	74.0	193.4	6.00	84.28*x*	1,157.0
Aug. 8	do	78.5	222.5	6.22	84.62*x*	1,384.0
Aug. 14	do	78.0	203.5	5.96	84.30*x*	1,217.0
Sept. 14	do	103.0	158.4	3.83	83.07*x*	607.0*n*
Oct. 24	do	75.5	115.6	3.06	82.35*x*	354.0

x Water surface elevation referred to bench-mark.
e Discharge estimated.
n Discharge measured at miscellaneous section 5,000 feet below regular section.

BIGHORN RIVER NEAR MOUTH OF STREAM

Location.—Tp. 39, Rge. 16, W. 5th Mer., and about two miles above mouth of stream.

Records available.—Discharge measurements only, during open water seasons 1915 and 1916.

Gauge.—None established.

Bench-mark.—Standard wooden, located on the left bank, about 30 feet from water edge and about 100 feet up stream from cable; assumed elevation 100.00 feet. The bench-mark used during 1915 is located 600 feet down stream from cable.

Channel.—Shifting, consisting of sand, gravel and small boulders.

Discharge measurements.—Made from a cable and by wading.

Winter flow.—Affected by ice from November to May.

Floods.—The maximum flow during 1916 occurred about June 19, when the water surface reached an elevation of 92.00 feet; the lower flats were inundated.

Observer.—None available.

DISCHARGE MEASUREMENTS of Bighorn river near mouth of stream, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
May 5	O. H. Hoover	56.0	52.0	3.75	89.56*x*	195
May 18	do	39.5	40.4	2.82	89.29*x*	114
June 15	C. M. O'Neil	68.0	109.6	6.46	90.18*x*	707
July 7	do	51.0	80.9	5.98	90.40*x*	484
July 28	do	79.0	86.6	5.23	90.13*x*	453
Aug. 16	do	47.5	50.8	4.13	90.03*x*	210
Sept. 13	do	44.0	52.3	3.63	89.53*x*	190
Oct. 25	do	31.6	28.5	2.81	89.10*x*	80*n*
Oct. 26	do	44.0	35.4	2.41	89.10*x*	85

n Discharge measurement at miscellaneous section 1,000 feet below regular section.
x Water surface elevation referred to bench-mark.
Shifting conditions throughout season.

MARTIN CREEK NEAR NORDEGG

Location.—SE. ¼ Sec. 27, Tp. 40, Rge. 15, W. 5th Mer., about one-quarter mile due south of the Canadian Northern railway depot at Nordegg, and three hundred feet up stream from the town power plant.

Records available.—June 12, 1915, to December 31, 1916. From July 11, 1916, to July 25, 1916, no gauge heights were recorded.

Gauge.—Vertical staff; zero maintained at an elevation of 95.31 feet from June 12, 1915, to June 2, 1916, and at an elevation of 94.31 feet from June 2 to end of 1916.

Bench-mark.—Standard wooden, located on the left bank about forty feet down stream from the gauge; assumed elevation 100.00 feet.

Channel.—Shifting, consisting of sand, gravel and clay.

Discharge measurements.—Made by current-meter from a plank spanning creek and by a 15-inch weir.

Winter flow.—Stream affected by ice from November to May.

Floods.—During 1916 there was no excessive flooding. A gauge height of 2.07 on May 1 was the maximum for the open water period.

Observer.—F. Birch, January 1 to July 10, 1916. Wm. Roxborough, July 26 to December 31, 1916.

Accuracy.—The open water discharge curve is defined by twelve measurements well distributed over the season and as all measurements plotted fell fairly close to the curve, the discharges computed from the curve will be well within the required degree of accuracy. Gauge heights were interpolated from July 11 to July 25 inclusive, and may be considered accurate to within 0.03 feet.

Discharge Measurements of Martin creek near Nordegg, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Feb. 18	S. H. Frame	Creek	frozen to	bottom	.....	Nil
Mar. 17	O. H. Hoover	"	"	"	.....	"
Mar. 27	do	"	"	"	.....	"
May 2	do	3.30	2.28	1.71	1.99	3.90
May 3	do	3.40	2.03	0.96	1.85	1.94
May 20	do	.....	.....	.....	1.55	0.21*w*
May 22	do	.....	.....	.....	1.54	0.16*w*
May 31	C. M. O'Neil	4.50	2.71	1.52	2.02	4.14
June 13	do	4.60	1.49	0.48	1.61	0.72
July 25	do	.....	.....	.....	1.75	1.39*w*
July 26	do	6.50	5.88	0.39	1.85	2.28
Aug. 19	do	6.50	6.00	0.53	1.90	3.19
Aug. 28	do	6.00	4.89	0.31	1.75	1.50
Sept. 26	do	.....	.....	.....	1.69	0.67*w*
Oct. 28	do	.....	.....	.....	1.58	0.32*w*
Dec. 5	do	.....	.....	.....	1.32	0.02*wi*

w Discharge determined by 15-inch weir.
i Stream frozen over.

Daily Gauge Height and Discharge of Martin creek near Nordegg, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	Dry *b*	Nil	Dry	Nil	1.37	Nil	2.22	0.10	2.07	4.88	1.97	3.67
2	"	"	"	"	1.30	"	2.03	0.20	1.98	3.79	1.95	3.42
3	"	"	"	"	1.26	"	2.15	0.30	1.85	2.28	1.94	3.30
4	"	"	"	"	1.20	"	2.21	0.40	1.72	1.19	1.82	2.02
5	"	"	"	"	1.17	"	2.25	0.44	1.70	1.04	1.80	1.84
6	"	"	"	"	0.91	"	2.30	0.46	1.72	1.19	1.76	1.48
7	"	"	"	"	0.97	"	2.42	0.50	1.68	0.90	1.70	1.04
8	"	"	"	"	1.22	"	2.44	0.52	1.68	0.90	1.67	0.84
9	"	"	"	"	1.62	"	2.21	0.54	1.64	0.64	1.67	0.84
10	"	"	"	"	1.76	"	2.18	0.56	1.56	0.25	1.66	0.77
11	"	"	"	"	1.84	"	2.19	0.58	1.58	0.33	1.65	0.70
12	"	"	"	"	1.92	"	2.20	0.58	1.60	0.41	1.61	0.47
13	"	"	"	"	1.92	"	2.22	0.60	1.54	0.19	1.60	0.41
14	"	"	"	"	1.92	"	1.89	0.62	1.54	0.19	1.60	0.41
15	"	"	"	"	1.85	"	2.00	0.64	1.54	0.19	1.60	0.41
16	"	"	1.57*x*	"	0.96	"	1.94	0.68	1.53	0.17	1.60	0.41
17	"	"	1.77	"	1.56	"	1.84	0.73	1.54	0.19	1.58	0.33
18	"	"	1.77	"	0.92	"	1.84	0.76	1.53	0.17	1.58	0.33
19	"	"	1.77	"	1.02	"	1.82	0.82	1.55	0.21	1.57	0.29
20	"	"	1.72	"	1.15	"	1.84	0.90	1.55	0.21	1.56	0.25
21	"	"	1.72	"	1.75	"	1.84	1.00	1.55	0.21	1.59	0.37
22	"	"	1.68	"	2.00	"	1.67	1.08	1.50	0.10	1.59	0.37
23	"	"	1.66	"	2.03	"	1.73	1.12	1.60	0.41	1.60	0.41
24	"	"	1.40	"	2.00	"	1.80	1.24	1.63	0.58	1.61	0.47
25	"	"	1.50	"	2.07	"	1.70*b*	0.58	1.89	2.71	1.62	0.53
26	"	"	1.49	"	2.03	"	1.86	2.38	1.86	2.38	1.62	0.53
27	"	"	1.49	"	1.92	"	1.84	2.17	2.08	5.00	1.64	0.64
28	"	"	1.48	"	1.92	"	1.64	0.64	2.00	4.03	1.62	0.53
29	"	"	1.42	"	1.92	"	1.67	0.84	2.03	4.39	1.64	0.64
30	"	"	.....	.....	1.97	Nil	1.76	1.48	2.05	4.64	1.64	0.64
31	Dry	Nil	.....	.....	2.02	0.04	.....	.....	2.02	4.27	.....	.....

b Ice conditions from January 1 to April 25.
Feb. 16 to Mar. 30.—Gauge heights recorded are of small amount water flooding over ice during daytime.
x Gauge is set in pool.

DAILY GAUGE HEIGHT AND DISCHARGE of Martin creek near Nordegg, for 1916.—*Concluded.*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1....	1.63	0.58	1.82	2.02	1.74	1.34	1.64	0.64	1.57	0.31	1.32	0.02
2....	1.63	0.58	1.77	1.74	1.77	1.34	1.64	0.64	1.60	0.31	1.32	0.02
3....	1.69	0.98	1.82	2.02	1.78	1.71	1.63	0.58	1.56	0.30	1.45	0.02
4....	1.80	1.84	1.78	1.71	1.84	2.19	1.63	0.58	1.57	0.28	1.45	0.02
5....	1.80	1.84	1.78	1.71	1.76	1.48	1.63	0.58	1.54	0.28	1.40	0.02
6....	1.78	1.71	1.78	1.71	1.74	1.34	1.64	0.64	1.57	0.27	0.95	0.02
7....	1.78	1.71	1.79	1.78	1.75	1.42	1.64	0.64	1.50	0.23	Dry	Nil
8....	1.85	2.28	1.79	1.78	1.75	1.42	1.63	0.58	1.50	0.21	"	"
9....	1.79	1.78	1.90	2.82	1.76	1.48	1.62	0.53	1.50	0.20	"	"
10....	1.77	1.74	1.79	1.78	1.75	1.42	1.61	0.47	1.50	0.20	"	"
11....	1.77*a*	1.74	1.80	1.84	1.74	1.34	1.60	0.41	1.46	0.18	"	"
12....	1.78*a*	1.71	1.80	1.84	1.74	1.34	1.60	0.41	1.45	0.16	"	"
13....	1.79*a*	1.78	1.79	1.78	1.75	1.42	1.60	0.41	1.42	0.14	"	"
14....	1.80*a*	1.84	1.77	1.74	1.75	1.42	1.60	0.41	1.45	0.13	"	"
15....	1.80*a*	1.84	1.73	1.27	1.73	1.27	1.60	0.41	1.50	0.13	1.05*x*	"
16....	1.81*a*	1.93	1.71	1.12	1.72	1.19	1.60	0.41	1.46	0.13	1.40*x*	"
17....	1.81*a*	1.93	1.81	1.93	1.72	1.19	1.63	0.58	1.50	0.13	0.65*x*	"
18....	1.81*a*	1.93	1.92	3.06	1.70	1.04	1.60	0.41	1.72	0.13	Dry	"
19....	1.82*a*	2.02	1.90	2.82	1.68	0.90	1.60	0.41	1.62	0.13	"	"
20....	1.82*a*	2.02	1.90	2.82	1.67	0.84	1.60	0.41	1.55	0.13	"	"
21....	1.83*a*	2.10	1.87	2.50	1.67	0.84	1.60	0.41	1.55	0.12	"	"
22....	1.83*a*	2.10	1.86	2.39	1.67	0.84	1.59	0.37	1.55	0.11	"	"
23....	1.84*a*	2.19	1.82	2.02	1.66	0.77	1.59	0.37	1.50	0.09	"	"
24....	1.84*a*	2.19	1.80	1.84	1.66	0.77	1.58	0.33	1.45	0.07	"	"
25....	1.85*a*	2.28	1.80	1.84	1.69	0.97	1.59	0.37	1.48	0.06	"	"
26....	1.85	2.28	1.78	1.71	1.67	0.84	1.58	0.33	1.35	0.04	"	"
27....	1.85	2.28	1.76	1.48	1.65	0.70	1.57	0.29	1.42	0.04	"	"
28....	1.87	2.50	1.75	1.42	1.64	0.64	1.58	0.33	1.30	0.03	"	"
29....	1.86	2.39	1.74	1.34	1.64	0.64	1.57*b*	0.33	1.38	0.03	"	"
30....	1.84	2.19	1.74	1.34	1.65	0.70	1.56	0.32	1.35	0.03	"	"
31....	1.81	1.93	1.74	1.34	.....	.....	1.57	0.32	.....	.....	"	" *b*

x Ice flooding from melting snow (chinook) and freezes to surface below gauge.
a Gauge height interpolated.
b Ice conditions October 29 to December 31.

MONTHLY DISCHARGE of Martin creek near Nordegg, for 1916

(Drainage area 4 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	Nil	Nil	.....	.....	.....	.....
February	"	"	.....	.....	.....	.....
March	0.04	"	.....	.....	.....	.....
April	2.38	0.10	0.78	0.195	0.218	46
May	5.00	0.10	1.55	0.388	0.447	95
June	3.67	0.25	0.94	0.235	0.262	56
July	2.50	0.58	1.88	0.470	0.540	116
August	3.06	1.12	1.89	0.472	0.540	116
September	2.19	0.64	1.16	0.290	0.320	69
October	0.64	0.29	0.45	0.112	0.130	28
November	0.31	0.03	0.15	0.038	0.040	9
December	0.02	0.00	.....	.....	.....	.....
The year	.....	.....	.....	.....	2.50	535

SHUNDA (MIRE) CREEK NEAR SAUNDERS

Location.—Tp. 40, Rge. 13, W. 5th Mer., about two and one-half miles southwest of Saunders on the Canadian Northern railway.

Records available.—June 1 to June 30, 1915; August 4 to November 29, 1915, and January 1 to December 31, 1916.

Gauge.—Vertical staff; elevation of zero maintained at 90.51 feet since establishment.

Bench-mark.—Standard wooden, located on left bank about 100 feet above gauge; assumed elevation 100.00 feet.

Channel.—Fairly permanent, consisting of sand, gravel and rock.

Discharge measurements.—Made from a cable or by wading.

Winter flow.—Stream affected by ice from November to May.

Floods.—No abnormal flooding occurred during the season 1916. The maximum gauge height of 4.20 feet was reached on August 18, 1916.

Observer.—Thos. Rees.

Accuracy.—Gauge heights observed to one-hundredth of a foot daily and time of observation was approximately time of mean daily gauge height.

DISCHARGE MEASUREMENTS of Shunda creek near Saunders, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 21	O. H. Hoover	14.0	9.60	1.15	.....	11.1*i*
Mar. 15	do	11.5	11.60	1.81	1.40	21.0
Mar. 29	do	10.5	12.00	1.67	1.41	20.0
April 28	do	17.3	24.00	1.47	1.65	35.0
April 29	do	18.4	25.00	1.68	1.64	42.0
May 25	do	37.0	48.00	2.09	2.04	101.0*n*
July 12	C. M. O'Neil	35.0	51.00	2.59	2.22	132.0
July 23	do	37.5	36.40	1.74	1.84	63.0
Aug. 21	do	68.0	87.60	3.40	2.78	313 0*m*
Aug. 25	do	35.5	56.00	2.47	2.29	138.0
Sept. 27	do	36.5	43.00	1.72	1.90	73 0
Nov. 1	do	36.2	39.70	1.56	1.88	62.0
Dec. 6	do	30.0	16.80	1.16	1.95	19 5*i*

i Stream frozen over.
m Discharge measured at miscellaneous section 500 feet above gauge.
n 100 feet below gauge.

DAILY GAUGE HEIGHT AND DISCHARGE of Shunda creek near Saunders, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.48*b*	15.2	3.60	13.5	1.56	17.4	2.39	22	1.75	54	3.52	610
2	1.48	14.6	3.62	14.0	1.49	17.5	2.41	22	1.72	50	3.22	490
3	1.48	14.2	3.79	14.2	1.46	17.7	2.43	22	1.72	50	2.59	238
4	1.50	13.6	3.81	14.4	1.46	18.2	2.42	22	1.72	50	2.51	210
5	1.50	13.0	3.83	14.6	1.44	18.8	1.59	22	1.72	50	2.51	210
6	1.50	12.4	3.76	14.7	1.44	19.4	1.59	22	1.70	48	2.38	170
7	1.50	12.0	3.10	14.9	1.44	20.0	1.60	22	1.70	48	2.29	146
8	1.50	11.6	2.42	15.2	1.45	20.0	1.62	22	1.70	48	2.15	114
9	1.52	11.2	1.67	15.3	1.45	21.0	1.64	23	1.71	49	2.15	114
10	1.53	11.0	1.69	15.6	1.50	21.0	2.65	24	1.68	46	2.20	125
11	1.53	11.0	1.69	16.0	1.53	22.0	2.61	24	1.66	44	2.23	132
12	1.53	11.0	2.10	16.3	1.53	22.0	2.64	25	1.64	42	2.23	132
13	1.55*a*	11.0	2.56	16.6	1.52	22.0	1.85	25	1.62	40	2.27	140
14	1.57*a*	11.0	2.58	16.8	1.47	21.0	1.82	25	1.61	40	2.15	114
15	1.58*a*	11.0	2.61	17.2	1.40	21.0	1.82	25	1.62	40	2.04	94
16	1.60*a*	11.0	2.65	17.3	1.32	21.0	1.79	25	1.62	40	2.00	88
17	1.60*a*	11.0	2.63	17.5	1.32	21.0	1.65	26	1.59	38	1.96	82
18	1.62*a*	11.0	1.59	17.5	1.34	21.0	1.69	27	1.59	38	1.95	81
19	1.62*a*	11.1	1.59	17.5	1.35	21.0	1.76	27	1.59*a*	38	1.93	77
20	1.64*a*	11.1	1.59	17.5	1.43	21.0	1.85	28	1.60*a*	38	2.90	362
21	1.67	11.1	1.61	17.5	1.41	21.0	1.78	29	1.61	40	2.87	350
22	1.80	11.1	1.63	17.4	1.41	21.0	1.67	30	1.66	44	2.87	350
23	1.77	11.2	1.65	17.4	1.39	21.0	1.59	31	1.74	53	2.82	330
24	1.77	11.3	1.65	17.3	1.37	20.0	1.54	32	1.82	62	2.81	326
25	1.80	11.4	1.69	17.2	1.37	20.0	1.59	33	2.04	94	2.55	224
26	1.96	11.7	1.72	17.2	1.39	20.0	1.61	34	2.37	167	2.52	213
27	2.59	11.9	1.79	17.2	1.41	20.0	1.61	34	2.48	200	2.50	206
28	2.59	12.0	1.76	17.3	1.41	20.0	1.65	35	2.60	242	2.38	170
29	2.53	12.2	1.68	17.4	1.41	20.0	1.65	40	2.65	262	2.16	117
30	2.58	12.2	.....	.....	1.40	20.0	1.64*b*	47	3.21	486	2.33	156
31	2.59	12.2	.....	.....	1.47	21.0	.....	.....	3.44	578	.....	.....

a Gauge height interpolated.
b Ice conditions, January 1 to April 30.

DAILY GAUGE HEIGHT AND DISCHARGE of Shunda creek near Saunders, for 1916—*Concluded*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.11	106	2.39	172	2.59	238	1.89	72	1.88	70	1.91	20.0
2	2.54	220	2.43	184	2.61	246	1.87	69	1.86	68	1.90	20.0
3	2.10	104	2.54	220	2.90	362	1.87	69	1.83	64	1.90	20.0
4	3.53	614	2.55	224	3.42	570	1.86	68	1.81	60	1.89	19.0
5	3.46	586	2.60	242	3.40	562	1.86	68	1.79	58	1.88*a*	19.0
6	2.70	281	2.52	213	3.27	510	2.13	110	1.79	58	1.87*a*	19.0
7	2.63	254	2.50	206	2.89	358	2.01	90	1.77*b*	56	1.86	19.0
8	2.54	220	2.48	200	2.58	234	1.95	80	1.77	50	2.00	19.0
9	2.64	258	2.74	297	2.45	190	1.92	76	1.76	38	2.03	20.0
10	2.59	238	2.52	213	2.37	167	1.90	73	1.63	38	2.05	20.0
11	2.33	156	2.41	178	2.29	146	1.90	73	1.65	38	2.10	20.0
12	2.22	130	2.27	141	2.23	132	1.89	72	1.79	38	2.00	20.0
13	2.24	134	2.25	136	2.25	136	1.89	72	2.89	38	1.99	20.0
14	2.23	132	2.11	106	2.19	123	1.89	72	2.59	37	1.97	20.0
15	2.21	227	2.07	99	2.15	114	1.89	72	2.13	34	1.92	20.0
16	2.21	227	2.00	88	2.11	106	1.93	78	2.10	30	1.86	20.0
17	2.19	123	2.26	139	2.05	96	1.96	82	1.99	28	1.83	20.0
18	2.48	200	4.20	882	2.00	88	2.01	90	1.95	27	1.81	19.0
19	2.05	97	3.64	658	1.97	84	2.06	98	1.93	27	1.77	19.0
20	2.01	90	3.22	490	1.95	80	2.05	96	1.91	27	1.77	19.0
21	2.00	88	2.78	314	1.91	74	2.03	93	1.90	25	1.76	19.0
22	1.96	82	2.69	277	1.85	66	2.01	90	1.87	24	1.73	19.0
23	1.85	66	2.58	235	1.85	66	2.00	88	1.78	23	1.66	19.0
24	1.89	72	2.39	172	1.83	64	1.99	86	2.05	23	1.66	19.0
25	2.64	258	2.29	145	1.91	74	2.01	90	2.09	23	1.65	19.0
26	3.42	570	2.23	132	1.91	74	2.02	91	2.05	23	1.64	18.0
27	3.95	782	2.14	112	1.90	73	2.01	90	1.90	23	1.60	18.0
28	3.78	714	2.09	102	1.90	73	1.99	86	1.90	22	1.57	18.0
29	2.85	342	2.05	96	1.90	73	1.96	82	1.91	22	1.59	18.0
30	2.63	254	2.01	90	1.89	72	1.91	74	1.91	21	1.63	18.0
31	2.45	190	2.25	136	.....	.....	1.92	76	.....	.....	1.64*b*	18.0

b Ice conditions, November 7 to December 31.
a Gauge height interpolated.

MONTHLY DISCHARGE of Shunda creek near Saunders, for 1916

(Drainage area 144 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	15.2	11.0	11.8	0.082	0.09	728
February	17.5	13.5	16.3	0.113	0.12	938
March	22.0	17.4	20.0	0.141	0.16	1,243
April	47.0	22.0	28.0	0.194	0.22	1,666
May	578.0	38.0	101.0	0.699	0.80	6,210
June	610.0	77.0	206.0	1.430	1.60	12,258
July	782.0	66.0	252.0	1.750	2.02	15,495
August	882.0	88.0	222.0	1.540	1.78	13,650
September	570.0	64.0	175.0	1.220	1.36	10,413
October	110.0	68.0	81.0	0.562	0.65	4,980
November	70.0	21.0	37.0	0.257	0.29	2,202
December	20.0	18.0	19.2	0.133	0.15	1,181
The year	.....	.....	.....	.....	9.24	70,964

NORTH SASKATCHEWAN RIVER NEAR SAUNDERS

Location.—Sec. 14, Tp. 40, Rge. 13, W. 5th Mer., and about two miles southwest of Saunders on the Canadian Northern railway.

Records available.—August 4 to December 31, 1915, and January 1 to December 31, 1916.

Gauge.—Vertical and slope staff combined; zero maintained at an elevation of 81.18 feet since establishment.

Bench-mark.—Standard wooden, located on the left bank 104 feet above cable; assumed elevation 100.00 feet.

Channel.—Fairly permanent; consisting of gravel, boulders and rock.

Discharge measurements.—Made from a cable.

Winter flow.—Stream affected by ice from November to May.

Floods.—The maximum gauge height during 1916 was 9.63 feet, on June 20. No flooding of banks occurred and only a small amount of debris was carried.

Observer.—Thos. Rees, January 1 to December 31.

Accuracy.—The control remained fairly constant throughout the season. The plot of the gauge heights and discharge measurements gives a very smooth curve and as daily gauge heights were read to one-hundredth of a foot at time of mean daily flow the resulting computations are well within the maximum limit of error.

DISCHARGE MEASUREMENTS of North Saskatchewan river near Saunders, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 22	O. H. Hoover	68	377	0.88	3.35	332*i*
Mar. 15	do	65	348	1.31	3.57	454*i*
Mar. 29	do	65	346	1.32	3.42	457*i*
April 29	do	249	339	2.51	1.93	852
May 25	do	271	591	3.15	2.87	1,864
July 12	C. M. O'Neil	286	2,059	7.34	7.66	15,221
July 22	do	282	1,395	5.19	5.53	7,241
Aug. 21	do	280	1,152	4.62	4.71	5,321*x*
Aug. 22	do	280	1,152	4.62	4.71	5,321
Aug. 25	do	284	1,578	6.07	6.14	9,575
Sept. 28	do	272	793	3.70	3.40	2,934
Nov. 1	do	255	550	3.17	2.42	1,744
Dec. 8	do	200	514	0.89	2.72	456*i*

x Slope measurement.
i Ice conditions.

DAILY GAUGE HEIGHT AND DISCHARGE of North Saskatchewan river near Saunders, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.98*b*	660	3.62	374	3.45	435	3.57	476	3.14	2,554	3.51	3,098
2	3.97	640	3.68	380	3.43	434	3.57	488	3.10	2,496	3.79	3,590
3	3.95	620	3.68	385	3.52	438	3.59	504	2.98	2,322	4.01	3,980
4	3.98	600	3.66	392	3.54	440	3.59	520	2.98	2,322	3.95	3,870
5	3.93	570	3.67	400	3.58	445	3.45	536	2.96	2,294	3.91	3,802
6	3.94	545	3.61	402	3.58	460	3.48	554	2.90	2,210	3.86	3,714
7	3.95	525	3.50	410	3.67	468	3.48	570	2.87	2,168	3.79	3,590
8	3.93	520	3.56	420	3.76	482	3.52	586	2.83	2,112	3.72	3,467
9	3.93	500	3.58	430	3.78	495	3.54	604	2.79	2,056	3.76	3,538
10	3.94	490	3.60	440	3.98	502	3.56	620	2.56	1,734	3.82	3,643
11	3.94	485	3.61	448	4.08	506	3.52	640	2.40	1,510	3.85	3,698
12	3.92	480	3.63	455	3.88	480	3.54	668	2.36	1,454	4.21	4,376
13	3.86*a*	480	3.63	462	3.69	468	2.48	710	2.28	1,342	4.27	4,494
14	3.80*a*	480	3.67	472	3.67	456	2.46	820	2.26	1,314	4.31	4,574
15	3.74*a*	470	3.73*a*	483	3.66	454	2.43*b*	1,180	2.19	1,216	5.35	6,875
16	3.68*a*	460	3.78*a*	490	3.52	450	2.36	1,454	2.28	1,342	6.77	11,492
17	3.62*a*	440	3.83*a*	498	3.58	446	2.00	950	2.32	1,398	7.91	16,500
18	3.56*a*	420	3.90	500	3.47	446	2.00	925	2.39	1,496	8.38	18,689
19	3.50*a*	400	3.97	504	3.46	446	1.98	925	2.47	1,608	9.14	22,208
20	3.43*a*	365	3.97	508	3.71	446	1.98	925	2.56	1,734	9.63	24,478
21	3.36	345	4.09	514	3.66	446	1.98	925	2.79	2,056	9.56	24,153
22	3.36	332	4.28	520	3.65	448	1.98	925	2.83	2,112	9.00	21,560
23	3.34	330	4.37	524	3.54	448	1.80	700	2.86	2,154	8.95	21,328
24	3.32	335	4.50	516	3.49	448	1.93	862	2.90	2,210	8.77	20,495
25	3.45	340	4.25	505	3.46	448	1.98	925	2.85	2,140	7.74	15,687
26	3.47	350	4.12	485	3.54	450	2.00	950	2.89	2,196	7.66	15,305
27	3.59	355	3.73	456	3.60	455	2.12	1,118	2.95	2,280	7.80	15,974
28	3.59	358	3.56	440	3.51	458	2.09	1,076	3.24	2,700	7.64	15,209
29	3.56	360	3.48	438	3.42	457	1.95	888	3.62	3,290	7.70	15,496
30	3.54	365	.....	.....	3.29	460	1.83	738	3.59	3,238	6.84	11,764
31	3.54	370	.....	.....	3.55	468	.....	.....	3.56	3,186	.....	.....

b Ice conditions January 1 to April 15.
a Gauge height interpolated.

DAILY GAUGE HEIGHT AND DISCHARGE of North Saskatchewan river near Saunders, for 1916.—*Concluded.*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1....	6.57	10,720	5.73	7,963	6.27	9,691	3.00	2,350	2.42	1,538	2.35	580
2....	6.86	11,840	5.88	8,428	6.35	9,955	2.87	2,168	2.39	1,496	2.49	556
3....	6.90	11,994	6.35	9,955	6.39	10,087	2.78	2,042	2.25	1,300	2.56	536
4....	6.86	11,840	5.98	8,738	6.41	10,153	2.75	2,000	2.20	1,230	2.69	518
5....	6.84	11,763	6.22	9,526	6.19	9,097	2.71	1,944	2.19	1,216	2.67*a*	500
6....	7.17	13,114	5.86	8,366	6.05	8,965	2.67	1,888	2.13	1,132	2.65*a*	480
7....	7.19	13,201	5.88	8,428	5.73	7,963	2.65	1,860	2.05*b*	1,040	2.63	460
8....	7.21	13,287	5.90	8,490	5.49	7,225	2.61	1,804	2.03	1,006	2.75	456
9....	7.61	15,066	6.45	10,285	5.25	6,875	2.57	1,747	2.01	980	2.99	456
10....	8.14	17,578	6.27	9,691	4.83	5,643	2.55	1,720	2.00	960	3.54	458
11....	7.68	15,400	5.95	8,645	4.48	4,712	2.54	1,706	1.92	900	3.56	460
12....	7.70	15,496	5.60	7,560	4.37	4,612	2.53	1,692	1.69	840	3.54	458
13....	8.51	19,291	5.65	7,715	4.25	4,456	2.59	1,776	1.25	406	3.53	456
14....	7.64	15,209	5.83	8,273	4.13	4,218	2.65	1,860	3.95	1,120	3.51	446
15....	6.86	11,840	6.08	9,064	3.90	3,784	2.72	1,958	1.48	640	3.41	440
16....	7.43	14,238	6.16	9,328	3.81	3,626	2.85	2,140	1.76	492	3.29	440
17....	7.95	16,691	6.30	9,790	3.83	3,662	3.29	2,773	1.79	760	3.43	440
18....	7.54	14,731	5.79	8,149	3.83	3,662	3.65	3,344	1.81	848	3.55	440
19....	7.23	13,374	5.40	7,000	3.78	3,572	4.00	3,960	1.79	852	3.62	440
20....	6.46	10,318	5.16	6,400	3.74	3,504	2.65	1,860	1.77	846	3.64	438
21....	5.98	8,738	4.78	5,538	3.69	3,414	2.64	1,846	1.75	838	3.76	438
22....	5.53	7,343	4.70	5,370	3.68	3,396	3.15	2,569	1.73	825	3.83	436
23....	5.36	6,900	5.28	6,700	3.65	3,344	3.10	2,496	1.70	808	3.91	434
24....	5.77	8,087	6.05	8,965	3.69	3,414	2.95	2,280	1.73	792	3.90	428
25....	6.19	9,427	6.14	9,262	3.81	3,626	2.91	2,224	1.75	766	3.89	420
26....	6.54	10,604	6.15	9,295	3.69	3,414	2.87	2,168	1.75	740	3.92	420
27....	6.47	10,351	5.95	8,645	3.45	3,007	2.85	2,140	1.76	720	3.99	422
28....	7.52	14,636	5.87	8,397	3.40	2,934	2.69	1,916	1.85	690	4.03	428
29....	6.75	11,415	5.86	8,366	3.17	2,598	2.58	1,763	1.94	650	4.00	440
30....	5.71	7,901	5.83	8,273	3.09	2,481	2.52	1,678	2.10	615	3.88	456
31....	5.64	7,684	5.94	8,614	.....	.....	2.49	1,636	.....	.....	3.82*b*	464

b Ice conditions November 7 to December 31.
a Gauge height interpolated.

MONTHLY DISCHARGE of North Saskatchewan river near Saunders, for 1916

(Drainage area 1,903 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	660	330	451	0.237	0.27	27,731
February	524	374	457	0.240	0.26	26,287
March	506	434	458	0.241	0.28	28,161
April	1,454	476	792	0.416	0.46	47,127
May	3,290	1,216	2,072	1.090	1.26	127,402
June	24,478	3,098	11,022	5.790	6.46	677,716
July	19,291	6,900	12,260	6.440	7.42	753,838
August	10,285	5,370	8,362	4.390	5.06	514,160
September	10,153	2,481	5,236	2.750	3.07	321,949
October	3,960	1,636	2,107	1.110	1.28	129,554
November	1,538	406	902	0.474	0.53	53,673
December	580	420	459	0.241	0.28	28,223
The year	.....	.....	.....	.....	26.63	2,735,821

RAM (SHEEP) RIVER NEAR LAMORAL

Location.—Tp. 39, Rge. 11, W. 5th Mer., about one mile above stream mouth.

Records available.—Discharge measurements only during the open water seasons 1915 and 1916.

Gauge.—None established.

Bench-mark.—Standard wooden, located on the right bank 250 feet above cable; assumed elevation 100.00 feet.

Channel.—Fairly permanent; consisting of sand, gravel and shale.

Discharge measurements.—Made from a cable or by wading.

Winter flow.—Stream affected by ice from November to May.

Floods.—During June, 1916, the stream reached its maximum stage for 1916. The water surface elevation was 92.40 feet but the banks did not overflow.

Observer.—None available.

DISCHARGE MEASUREMENTS of Ram river (formerly Sheep river) near Lamoral, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
May 26	C. M. O'Neil	175	525	4.40	91.53*x*	2,310*e*
July 20	do	230	374	2.42	90.94*x*	907
Aug. 23	do	236	612	3.73	91.78*x*	2,283
Oct. 7	do	226	296	1.78	90.41*x*	526
Nov. 4	do	206	254	1.61	90.30*x*	409

x Water elevation referred to bench-mark.
e Discharge estimated.

CLEARWATER RIVER NEAR ROCKY MOUNTAIN HOUSE

Location.—On the SE. ¼ Sec. 16, Tp. 39, Rge. 7, W. 5th Mer., on G. Fletcher's farm, three miles southwest of Rocky Mountain house.

Records available.—January 1, 1914, to December 31, 1916.

Gauge.—Chain gauge, located on left bank of river sixty feet up stream from the cable. There is a staff gauge on the right bank of the river, and in the same section, which is used by the observer during the open water season. The zero elevation of the gauges has been maintained at 3,105.04 feet since establishment.

Bench-mark.—Permanent iron bench-mark, three feet up stream from the cable tower on the right bank. Its elevation is 3,118.39 feet (Department of Public Works of Canada datum).

Channel.—One permanent channel at low water, and probably two in high stages.

Discharge measurements.—Made from a cable car.

Winter flow.—Stream affected by ice from November to April, and measurements are made 300 feet below the cable section.

Observer.—G. Fletcher.

DISCHARGE MEASUREMENTS of Clearwater river near Rocky Mountain house, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 20	O. H. Hoover	200	325	1.06	4.11	343
Feb. 17	S. H. Frame	201	300	1.01	4.38	304
Mar. 13	O. H. Hoover	175	325	1.20	4.45	389
April 3	do	180	399	1.57	4.70	626
April 27	do	192	626	1.01	2.29	636
May 24	R. J. McGuinness	195	667	1.25	2.60	831
June 14	H. S. Kerby	200	925	2.29	3.64	2,120
June 22	do	207	1,373	4.21	5.76	5,776
June 23	A. W. Lowrie	206	1,171	3.48	5.00	4,044
July 5	do	207	1,189	3.04	4.97	3,607
July 22	H. S. Kerby	202	917	2.17	3.65	1,991
Aug. 18	do	203	934	2.50	3.98	2,341
Sept. 6	do	210	1,216	3.30	5.13	4,012
Sept. 27	W. K. Broughton	203	787	1.80	3.22	1,418
Oct. 18	do	204	811	1.81	3.21	1,464
Nov. 14	C. M. O'Neil	198	797	0.94	3.36	747
Dec. 11	do	174	568	0.75	3.56	427

DAILY GAUGE HEIGHT AND DISCHARGE of Clearwater river near Rocky Mountain house, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.99*b*	321	4.09	291	4.37	302	4.62	575	2.72	939	5.27	4,282
2	3.88	321	4.11	292	4.32	302	4.76	610	3.58	1,816	4.69	3,355
3	3.81	313	4.16	293	4.22	301	4.75	626	3.55	1,780	4.34	2,836
4	3.77	302	4.19	294	4.20	308	4.69	630	3.45	1,660	4.54	3,130
5	3.79	302	4.17	294	4.15	315	4.63	622	3.22	1,406	4.67	3,325
6	3.83	306	4.17	294	4.15	323	4.62	612	3.10	1,280	4.37	2,878
7	3.77	313	4.20	294	4.18	331	4.62	602	3.22	1,406	4.10	2,500
8	3.70	317	4.22	296	4.18	342	4.76	616	3.12	1,301	4.00	2,360
9	3.69	315	4.23	297	4.23	351	4.90	643	2.85	1,043	4.03	2,402
10	3.68	310	4.23	298	4.31	362	4.89	646	2.65	887	4.03	2,402
11	3.77	303	4.28	298	4.56	372	4.84	647	2.40	716	3.83	2,134
12	3.86	302	4.28	299	4.51	382	4.73	645	2.35	685	3.70	1,965
13	3.99	304	4.30	300	4.44	389	4.62	642	2.30	654	3.66	1,915
14	4.03	310	4.32	301	4.47	388	4.61	641	2.25	625	3.66	1,915
15	4.02	319	4.34	302	4.34	380	4.61*b*	1,250	2.25	625	4.29	2,766
16	4.05	330	4.34	303	4.22	368	3.65	1,902	2.25	625	4.89	3,674
17	4.03	338	4.37	304	4.22	364	2.84	1,034	2.25	625	5.22	4,202
18	3.77	342	4.40	304	4.27	362	2.33	673	2.25	625	5.77	5,136
19	3.95	343	4.41	304	4.30	368	2.18	586	2.30	654	6.19	5,892
20	3.98	343	4.38	304	4.30	380	2.27	637	2.35	685	7.22	7,818
21	4.00	325	4.31	305	4.45	399	2.26	631	2.35	685	7.19	7,761
22	3.83	309	4.43	306	4.58	420	2.25	625	2.35	685	5.80	5,190
23	3.73	288	4.46	306	4.98	470	2.15	571	2.35	685	5.02	3,882
24	3.64	259	4.56	306	4.73	495	2.14	566	2.55	815	4.82	3,562
25	3.99	270	4.51	305	4.56	502	2.13	561	2.78	985	4.70	3,370
26	4.04	280	4.49	305	4.66	504	2.17	581	2.78	985	4.76	3,466
27	4.08	284	4.39	304	4.61	503	2.29	648	2.80	1,000	5.20	4,170
28	4.00	285	4.39	303	4.54	512	2.45	748	3.70	1,965	5.39	4,483
29	4.01	286	4.37	303	4.44	518	2.45	748	4.08	2,472	5.14	4,074
30	4.05	288	.....	.....	4.49	527	2.58	836	4.49	3,055	4.99	3,834
31	4.03	290	.....	.....	4.52	550	.....	.....	5.80	5,190	.....	.....

b Ice conditions, January 1 to April 15.

DAILY GAUGE HEIGHT AND DISCHARGE of Clearwater river near Rocky Mountain house, for 1916 —*Concluded*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.38	2,892	3.77	2,056	3.81	2,108	3.09	1,270	2.69	917	3.86	616
2	4.48	3,040	3.74	2,017	3.81	2,108	3.09	1,270	2.69	917	3.86	590
3	4.69	3,355	4.32	2,808	3.81	2,108	3.04	1,220	2.67	902	3.87	555
4	5.31	4,347	4.67	3,325	4.71	3,386	3.04	1,220	2.64	880	3.77	530
5	4.92	3,722	4.47	3,025	5.46	4,602	2.99	1,171	2.65	887	3.67	510
6	4.57	3,175	4.12	2,528	5.09	3,994	2.99	1,171	2.63	872	3.78	482
7	4.32	2,808	3.94	2,279	4.66	3,310	2.99	1,171	2.59	843	3.68	450
8	4.22	2,668	3.84	2,147	4.46	3,010	2.94	1,124	2.45*b*	740	3.59	426
9	5.17	4,122	3.82	2,121	4.41	2,935	2.91	1,095	2.48	740	3.69	410
10	5.12	4,042	3.72	1,991	4.21	2,654	2.89	1,077	2.55	790	3.49	420
11	4.87	3,642	3.70	1,965	4.01	2,374	2.89	1,077	3.12	900	3.53	427
12	4.74	3,434	3.67	1,928	4.01	2,374	2.89	1,077	2.82	790	3.70	431
13	4.62	3,250	3.57	1,804	3.96	2,306	2.89	1,077	3.52	764	3.65	433
14	4.57	3,175	3.42	1,624	3.91	2,238	2.84	1,034	3.33	747	3.76	433
15	4.40	2,920	3.42	1,624	3.80	2,095	2.84	1,034	3.35	744	3.71	430
16	4.17	2,598	3.42	1,624	3.75	2,030	2.84	1,034	3.31	735	3.86	425
17	3.90	2,225	3.67	1,928	3.52	1,744	2.97	1,152	3.41	726	3.72	417
18	3.74	2,017	3.92	2,252	3.40	1,600	3.10	1,280	3.41	715	3.72	410
19	4.57	3,175	5.30	4,330	3.38	1,578	3.14	1,322	3.32	704	3.73	404
20	4.07	2,458	5.67	4,959	3.35	1,545	3.09	1,270	3.22	690	3.63	398
21	3.77	2,056	4.92	3,722	3.32	1,512	3.09	1,270	3.23	670	3.63	395
22	3.64	1,890	4.70	3,370	3.30	1,490	3.04	1,220	3.13	654	3.54	393
23	3.47	1,684	4.51	3,085	3.29	1,480	3.04	1,220	3.13	650	3.44	390
24	3.54	1,768	4.51	3,085	3.29	1,480	3.04	1,220	3.54	655	3.44	388
25	3.87	2,186	4.46	3,010	3.24	1,427	3.04	1,220	3.84	665	3.45	385
26	4.32	2,808	4.26	2,724	3.24	1,427	3.04	1,220	3.85	675	3.15	384
27	4.57	3,175	4.11	2,514	3.20	1,385	2.99	1,171	3.85	675	3.16	383
28	4.62	3,250	3.83	2,134	3.19	1,374	2.91	1,095	3.70	665	3.26	381
29	4.47	3,025	3.76	2,043	3.09	1,270	2.87	1,060	3.71	653	3.26	380
30	4.27	2,738	3.71	1,978	3.09	1,270	2.79	992	3.76	639	3.27	380
31	3.97	2,320	3.71	1,978	.....	.....	2.74	954	.....	.....	3.27*b*	386

b Ice conditions, November 8 to December 31.

MONTHLY DISCHARGE of Clearwater river near Rocky Mountain house, for 1916

(Drainage area 1,214 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	343	259	307	0.253	0.29	18,877
February	306	291	300	0.247	0.27	17,256
March	550	301	399	0.329	0.38	24,534
April	1,902	561	712	0.586	0.65	42,367
May	5,190	625	1,244	1.025	1.18	76,491
June	7,818	1,[illegible]	3,689	3.039	3.39	219,511
July	4,347	1,[illegible]	2,902	2.390	2.76	178,437
August	4,959	1,624	2,515	2.072	2.39	154,641
September	4,602	1,270	2,140	1.763	1.97	127,340
October	1,322	954	1,154	0.951	1.10	70,957
November	917	639	753	0.620	0.69	44,807
December	616	380	434	0.357	0.41	26,686
The year	.....	.....	.....	.....	15.48	1,001,904

NORTH SASKATCHEWAN RIVER NEAR ROCKY MOUNTAIN HOUSE

Location.—On the NE. ¼ Sec. 21, Tp. 39, Rge. 7, W. 5th Mer., 2,000 feet below the railway bridge and one mile west of Rocky Mountain house.

Records available.—From June 2, 1913, to December 31, 1916.

Gauge.—Inclined staff graduated to feet and tenths. From June 2, 1913, to June 27, 1915, located 1,200 feet above the cable on the left bank. Zero elevation maintained at 3,108.39 feet from June 2, 1913, to October 23, 1913; zero elevation maintained at 3,108.42 feet from October 23, 1913, to June 27, 1915. After June 28, 1915, the gauge was located 20 feet below the cable, on the left bank, and has been maintained at a zero elevation of 3,108.47 feet.

Bench-mark.—On nails in a spruce tree, on the north side of the road allowance, on the left bank of the river and 50 feet from the edge of the bank; elevation 3,126.93 feet. (Department of Public Works of Canada datum.) On October 8, 1915, a permanent iron bench-mark was set on the left bank, 3 feet above the cable tower; elevation 3,125.96 feet. (Department of Public Works of Canada datum.)

Channel.—One channel at all stages.

Discharge measurements.—Made from a cable car.

Winter flow.—Stream affected by ice from November to April and measurements made 1,400 feet above the cable section.

Observers.—Wm. Austin, January 1, to October 31, and H. Gillespie, November 1 to December 31.

Accuracy.—The open water discharge curve passes through five out of nine actual meterings and the other points are all very close to the curve.

Gauge height observations are made to one-hundredth of a foot at the time of mean daily gauge heights. The curve is smooth and results are well within the limit of error.

The winter discharge is computed from gauge height observations, graphs of maximum and minimum temperatures and occasional measurements under ice conditions and is a reasonably fair estimate.

DISCHARGE MEASUREMENTS of North Saskatchewan river near Rocky Mountain house, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 24	O. H. Hoover	360	860	0.94	5.31	806
Feb. 18	S. H. Frame				6.68	820*e*
Mar. 11	O. H. Hoover	329	910	1.30	6.46	1,175
April 1	do	331	918	1.42	6.28	1,308
April 25	do	500	697	2.38	3.02	1,656
May 24	R. J. McGuinness	516	1,213	3.44	3.98	4,176
June 13	H. S. Kerby	512	1,844	4.05	5.34	7,490
June 13	do	510	1,805	4.04	5.29	7,292*x*
June 22	A. W. Lowrie	532	3,645	7.42	8.83	27,046*x*
June 23	do	521	3,302	6.57	8.18	21,694*x*
July 4	H. S. Kerby	520	3,271	6.54	8.12	21,406*x*
July 4	do	520	3,271	6.54	8.12	21,406
July 24	do	513	2,037	4.50	5.73	9,166
July 24	do	513	2,010	4.38	5.69	8,806
Aug. 17	do	516	2,269	4.97	6.30	11,281
Sept. 5	do	520	3,037	5.85	7.60	17,757
Sept. 26	W. K. Broughton	513	1,614	4.13	5.01	6,659
Oct. 17	do	510	1,449	3.94	4.76	5,710
Nov. 13	C. M. O'Neil	515	1,850	1.68	6.71	3,100*e*
Dec. 9	do	412	1,449	1.10	5.08	1,579

e Discharge estimated from area, gauge height and velocity.
x Slope measurement.

DAILY GAUGE HEIGHT AND DISCHARGE of North Saskatchewan river near Rocky Mountain house, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	5.30*b*	1,422	5.16	770	5.86	808	6.30	1,308	3.48	2,400	5.63	8,608
2	5.25	1,405	5.16	780	5.71	818	6.35	1,330	3.95	3,040	5.83	9,360
3	5.20	1,383	5.21	790	5.61	834	6.45	1,390	4.75	4,820	5.96	9,886
4	5.16	1,332	5.26	800	5.51	852	6.50	1,444	4.98	5,100	6.48	12,122
5	5.11	1,306	5.36	800	5.61	868	6.35	1,490	4.88	5,020	6.12	10,556
6	5.11	1,302	5.41	802	5.60	888	6.30	1,590	4.65	4,680	5.77	9,126
7	5.16	1,295	5.51	804	5.71	912	6.40	1,600	4.58	4,580	5.54	8,290
8	5.12	1,287	5.56	810	5.71	950	6.50	1,675	4.32	4,150	5.39	7,777
9	5.17	1,265	5.51	814	5.81	1,010	6.65	1,760	3.95	3,500	5.45	7,980
10	5.22	1,220	5.56	810	6.11	1,142	6.85	1,834	3.75	3,280	5.43	7,912
11	5.17	1,160	5.61	800	6.36	1,175	6.50	1,864	3.57	3,080	5.25	7,315
12	5.13	1,132	5.61	795	6.51	1,180	6.25	1,861	3.49	3,020	5.05	6,660
13	5.18	1,110	5.66	795	6.46	1,175	6.10	1,852	3.41	2,960	5.19	7,117
14	5.23	1,100	5.71	800	6.31	1,160	6.15	1,884	3.41	2,980	5.59	8,465
15	5.33	1,100	5.76	800	6.16	1,150	6.25	1,918	3.35	2,990	6.84	13,796
16	5.39	1,102	5.76	805	6.16	1,142	6.25	1,932	3.39	3,040	8.06	20,286
17	5.44	1,100	6.36	810	6.11	1,140	6.15	1,930	3.43	3,100	8.54	22,998
18	5.44	1,090	6.60	820	6.06	1,142	4.85*ab*	1,890	3.40	3,100	9.69	29,641
19	5.49	1,040	6.41	828	6.06	1,150	3.55	2,320	3.49	3,250	10.01	31,602
20	5.40	942	6.16	826	6.11	1,170	3.51	2,264	3.80	3,760	10.94	37,368
21	5.35	875	6.11	828	6.21	1,190	3.43	2,159	3.81	3,820	10.61	35,322
22	5.40	840	6.16	833	6.26	1,206	3.41	2,133	3.84	3,900	9.03	25,791
23	5.35	812	6.31	840	6.21	1,212	3.31	2,021	3.73	3,710	8.15	20,790
24	5.31	806	6.26	840	6.16	1,220	3.25	1,955	3.98	4,176	7.55	17,510
25	5.31	775	6.26	830	6.09	1,220	3.15	1,760	4.18	4,442	7.48	17,134
26	5.16	742	6.16	822	6.06	1,224	3.21	1,850	4.33	4,769	7.50	17,240
27	5.11	730	6.11	818	6.11	1,234	3.42	2,080	4.76	5,822	8.40	22,200
28	5.11	720	6.01	804	6.16	1,260	3.51	2,340	5.06	6,692	8.53	22,941
29	5.16	730	5.96	800	6.46	1,280	3.46	2,300	5.57	8,395	8.30	21,630
30	5.16	730	.....	.....	6.41	1,290	3.28	2,140	5.87	9,520	7.75	18,590
31	5.11	750	.....	.....	6.36	1,300	.....	.....	5.80	9,240	.....	.....

a Gauge height interpolated.
b Ice conditions from January 1 to April 18.

DAILY GAUGE HEIGHT AND DISCHARGE of North Saskatchewan river near Rocky Mountain house, for 1916—*Concluded*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1....	6.83	13,747	6.37	11,638	6.68	13,038	4.49	5,137	3.94	3,992	5.46	2,260
2....	6.93	14,243	6.57	12,532	6.65	12,900	4.46	5,068	3.88	3,886	5.53	2,200
3....	7.45	16,975	6.97	14,447	6.88	13,992	4.47	5,091	3.80	3,750	5.66	2,090
4....	8.19	21,014	7.40	16,710	7.52	17,348	4.40	4,930	3.74	3,648	5.66	2,020
5....	7.75	18,590	6.92	14,192	7.50	17,240	4.27	4,634	3.77	3,699	5.37	1,920
6....	6.90	14,090	6.65	12,900	7.32	16,286	4.21	4,502	3.73	3,631	5.31	1,840
7....	6.75	13,365	6.34	11,506	6.68	13,038	4.17	4,423	3.64	3,484	5.05	1,750
8....	7.25	15,915	6.54	12,394	6.58	12,578	4.10	4,290	3.62	3,452	4.94	1,660
9....	8.30	21,630	6.76	13,412	6.40	11,770	4.07	4,233	3.57	3,375	5.20	1,579
10....	8.43	22,371	6.89	14,041	6.10	10,470	4.06	4,214	3.52	3,300	5.00	1,550
11....	8.18	20,958	6.36	11,594	5.72	8,936	4.05	4,195	4.76*b*	3,200	4.80	1,500
12....	8.08	20,398	6.69	13,084	5.42	7,878	4.01	4,119	6.60	3,160	5.00	1,510
13....	8.35	21,915	5.91	9,681	5.40	7,810	3.99	4,082	6.70	3,100	5.20	1,520
14....	8.68	23,796	5.86	9,480	5.25	7,315	3.92	3,956	6.60	3,055	5.25	1,520
15....	7.58	17,672	6.26	11,158	4.97	6,413	4.02	4,138	6.69	3,010	5.40	1,510
16....	6.81	13,649	6.39	11,726	4.75	5,795	4.06	4,214	6.65	2,970	5.49	1,500
17....	7.35	16,445	6.36	11,594	4.77	5,849	4.68	5,608	6.48	2,920	5.49	1,480
18....	8.15	20,790	6.56	12,486	4.62	5,452	5.40	7,810	6.49	2,880	5.49	1,450
19....	7.45	16,975	7.56	17,564	4.87	6,126	5.02	6,564	6.50	2,850	5.99	1,435
20....	6.90	14,090	6.84	13,796	5.02	6,564	4.85	6,070	5.99	2,810	6.29	1,410
21....	7.30	16,180	6.39	11,726	5.07	6,724	4.67	5,582	5.98	2,760	6.49	1,395
22....	6.58	12,578	6.14	10,642	4.90	6,210	4.61	5,426	5.98	2,710	6.79	1,390
23....	5.68	8,788	6.47	12,078	4.92	6,268	4.50	5,160	5.86	2,670	6.56	1,390
24....	5.70	8,860	6.89	14,041	4.85	6,070	4.42	4,976	5.59	2,640	6.53	1,390
25....	6.02	10,134	6.81	13,649	4.92	6,268	4.35	4,815	5.57	2,600	6.46	1,385
26....	6.90	14,090	6.69	13,084	4.87	6,126	4.29	4,678	5.58	2,550	6.53	1,380
27....	7.20	15,650	6.51	12,256	4.85	6,070	4.24	4,568	5.47	2,510	6.08	1,375
28....	7.35	16,445	6.41	11,814	4.62	5,452	4.13	4,347	5.37	2,460	6.18	1,370
29....	7.67	18,158	6.29	11,287	4.57	5,328	4.08	4,252	5.35	2,410	6.03	1,370
30....	6.35	11,550	6.34	11,506	4.44	5,022	4.08	4,252	5.36	2,330	6.07	1,375
31....	6.42	11,858	6.51	12,256	.....	.....	4.00	4,100	.....	.....	6.17*b*	1,380

b Ice conditions, November 11 to December 31.

MONTHLY DISCHARGE of North Saskatchewan river near Rocky Mountain house, for 1916

(Drainage area 4,162 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	1,422	720	1,052	0.253	0.29	64,685
February	840	770	809	0.194	0.21	46,534
March	1,300	808	1,107	0.266	0.31	68,067
April	2,340	1,308	1,862	0.447	0.50	110,797
May	9,520	2,400	4,398	1.057	1.22	270,422
June	37,368	6,660	16,534	3.973	4.43	983,841
July	23,796	8,788	16,233	3.900	4.50	998,129
August	17,564	9,480	12,589	3.025	3.49	774,067
September	17,348	5,022	8,878	2.133	2.38	528,278
October	7,810	3,956	4,820	1.158	1.33	296,370
November	3,992	2,330	3,060	0.735	0.82	182,082
December	2,260	1,370	1,578	0.379	0.44	96,966
The year	.....	.....	.....	.....	19.92	4,420,238

MEAN MONTHLY DISCHARGE in Second-feet of North Saskatchewan river at Rocky Mountain house

MONTH	1912-13	1913-14	1914-15	1915-16	1916-17	Mean in Sec.-feet	Mean in Acre-feet
October	.....	3,100	3,187	3,686	4,820	3,698	227,397
November	.....	1,892	1,753	1,994	3,060	2,175	129,405
December	.....	1,630	850	1,364	1,578	1,355	83,329
January	.....	848	833	1,052	.....	911	56,015
February	.....	729	751	809	.....	763	42,910
March	.....	862	681	1,107	.....	883	54,314
April	.....	1,114	1,451	1,862	.....	1,476	87,808
May	.....	4,104	5,934	4,398	.....	4,812	295,878
June	12,347*a*	10,808	22,894	16,534	.....	16,745	996,389
July	13,456	12,914	22,562	16,233	.....	16,291	1,001,717
August	13,550	8,916	16,753	12,589	.....	12,952	796,381
September	7,417	4,772	6,964	8,878	.....	7,008	416,989
Total in acre-feet	2,812,119	3,136,982	5,132,546	4,273,980	.....	.....	4,188,532

a 2-30.

SOUTHESK RIVER

Location.—Tp. 43, Rge. 20, W. 5th Mer., about five miles above mouth of stream, at Forestry ford.

Records available.—Discharge measurements only in 1915.

Gauge.—None established.

Bench-mark.—Standard wooden. Located on the left bank about 50 feet down stream from trail; assumed elevation 100.00 feet.

Channel.—Fairly permanent consisting of sand, gravel and rock.

Discharge measurements.—Made from a temporary cable.

Winter flow.—Stream affected by ice from November to May.

Observer.—None obtainable.

Remarks.—No discharge measurements were obtained in 1916.

BLACKSTONE RIVER NEAR GRASS MOUNTAIN

(Formerly South Branch of Brazeau river)

Location.—Tp. 43, Rge. 16, W. 5th Mer., about one-half mile above the mouth of Chungo creek.

Records available.—Discharge measurements only during open water seasons 1915 and 1916.

Gauge.—None established.

Bench-mark.—Standard wooden, located on the left bank 25 feet below cable; assumed elevation 100.00 feet.

Channel.—Shifting, consisting of sand, gravel and boulders.

Discharge measurements.—Made from a cable or by wading.

Winter flow.—Stream affected by ice from November to May.

Floods.—In 1916 the stream reached its maximum stage about June 16, when the water surface elevation relative to bench-mark was 95.80 feet.

Observer.—None available.

DISCHARGE MEASUREMENTS of Blackstone river (formerly South Brazeau) near Grass Mountain, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
June 8	C. M. O'Neil	153	264	3.20	95.19*x*	845*m*
Sept. 4	do	140	210	2.40	94.79*x*	503
Sept. 7	do	134	183	2.07	94.58*x*	379

x Water surface elevation referred to bench-mark.
m Discharge measured at miscellaneous section 2,000 feet above regular section.

CHUNGO CREEK

Location.—Tp. 43, Rge. 17, W. 5th Mer., about 300 feet above mouth of creek.
Records available.—Discharge measurements only during 1915 and 1916.
Gauge.—None established.
Bench-mark.—Standard wooden, located on the right bank in line with measuring section and thirty feet from normal water edge; assumed elevation 100.00 feet.
Channel.—Fairly permanent, consisting of sand, gravel and rock.
Discharge measurements.—Made by wading.
Winter flow.—Stream affected by ice from November to May.
Floods.—The stream reached its maximum stage in 1916, about June 16, when the water surface elevation was 88.30 feet relative to bench-mark. There was no flooding of banks.
Observer.—None available.

DISCHARGE MEASUREMENTS of Chungo creek near mouth of creek, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
June 9	C. M. O'Neil	45.5	73.0	2.04	87.40*x*	149
Sept. 1	do	42.5	53.0	1.68	86.57*x*	89

x Water surface elevation referred to bench-mark.

BROWN CREEK

Location.—Tp. 44, Rge. 17, W. 5th Mer., about five miles above the mouth of stream and near Forestry ford.
Records available.—Discharge measurements only during open water seasons 1915 and 1916.
Gauge.—None established.
Bench-mark.—Standard wooden, located on the left bank fifty feet below gauging section; assumed elevation 100.00 feet.
Channel.—Fairly permanent, consisting of sand, gravel and rock.
Discharge measurements.—Made by wading.
Winter flow.—Stream affected by ice from November to May.
Floods.—Maximum stage for 1916 was reached during June, the water surface elevation being 89.90 feet. There was no flooding of banks.
Observer.—None available.

DISCHARGE MEASUREMENTS of Brown creek, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
June 7	C. M. O'Neil	64.0	83.0	1.70	89.14*x*	141
Sept. 2	do	59.5	73.0	1.61	89.39*x*	118

x Water surface elevation referred to bench-mark.

NORTH SASKATCHEWAN RIVER AT ROCKY RAPIDS

Location.—On the NE. ¼ Sec. 10, Tp. 49, Rge. 7, W. 5th Mer.

Records available.—Data supplied by Sir John Jackson (Canada) Company Limited, from June 10, 1913, to May 2, 1914. Records by this office, January 1, 1915, to December 31, 1916.

Gauge.—Vertical staff on left bank; zero elevation maintained at 88.30 feet from November 15, 1915, to December 31, 1916.

Bench-mark.—Permanent iron bench-mark at foot of left bank cable tower; assumed elevation 125.53 feet.

Channel.—One channel at all stages.

Observers.—W. H. Kew, January 1 to August 5; J. L. Combs, October 29 to December 31. Between August 5 and October 29 no observer was available.

Accuracy.—Gauge heights at this station were read to one-hundredth of a foot. None were recorded between August 6 and October 28, 1916, as no observer was available.

Discharge measurements showed shifting conditions during the high water season, during which period the bed of the river filled with gravel and sand to a depth of seven feet in places.

There are two curves used, one previous to, and one after, high water conditions, and during high water from July 7 to August 19, conditions gradually shifted.

Either of the curves pass through all the plotted discharge measurement points with the exception of one during shifting conditions.

From August 6 to October 28, there was no observer and the discharges are estimates based upon the discharges at the station at Edmonton and upon four measurements at the Rocky Rapids station.

The control not being constant this was a difficult station, but the results recorded should be well within the maximum limit of error.

The winter records are based upon discharge measurements, daily gauge heights and temperature records and are a fair estimate of the discharge.

DISCHARGE MEASUREMENTS of North Saskatchewan river at Rocky rapids, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 11	R. J. McGuinness	420	2,395	0.56	6.35	1,336
Feb. 5	do	420	2,137	0.59	6.15	1,255
Mar. 7	do	420	2,008	0.48	6.04	972
Mar. 18	do	420	2,019	0.62	6.26	1,255
April 30	do	550	3.242	0.73	4.59	2,367*x*
May 24	C. McGavin	530	2,923	1.69	4.78	4,957
June 16	do	598	4,719	4.62	7.92	21,792
June 21	do	662	6,664	9.53	12.42	63,508*x*
July 7	do	601	4,552	6.03	8.66	27,477
July 7	do	601	4,552	6.03	8.66	27,477*x*
July 29	do	614	4,457	7.12	9.59	31,633
Aug. 19	do	603	3,965	6.84	8.80	27,108
Sept. 8	W. T. Reeve	592	3,663	6.16	8.20	22,563
Sept. 30	do	563	2,047	3.76	5.87	7,705
Oct. 29	do	546	1,991	3.74	5.71	7,449
Nov. 26	do		2,046	1.50	3.32	3,070*e*
Dec. 18	do	308	2,249	1.46	4.48	3,277

e Estimated from area and velocity.
x Slope measurement.

DAILY GAUGE HEIGHT AND DISCHARGE of North Saskatchewan river at Rocky rapids, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	6.07*b*	1,390	6.16	1,230	6.19	1,060	6.35	2,950	4.60	4,540	7.95	21,895
2	6.08	1,380	6.14	1,240	6.11	1,030	6.35	3,050	6.36	11.196	7.25	16,705
3	6.04	1,370	6.15	1,240	6.07	1,000	6.50	3,100	6.37	11,247	7.05	15,335
4	6.04	1,370	6.14	1,240	6.05	990	6.60	3,350	6.33	11,043	7.55	18,890
5	6.03	1,360	6.14	1,250	6.03	980	6.65	3,400	6.13	10,064	7.80	20,750
6	6.04	1,350	6.15	1,260	6.04	980	6.65	3,580	6.09	9,873	7.35	17,425
7	6.05	1,340	6.14	1,250	6.06	970	6.60	3,660	5.75	8,335	6.90	14,340
8	6 19	1,340	6.14	1,250	6.04	1,010	6.53	3,720	5.55	7,495	6.65	12,790
9	6 24	1,340	6.15	1,250	6.03	1,100	6.60	3,820	5.21	6,234	6.55	12,220
10	6.30	1,340	6.13	1,250	6.05	1,160	6.76	3,900	4.98	5,542	6.70	13,080
11	6.33	1,340	6.06	1,250	6.14	1,200	6.80	3,980	4.77	4,962	6.75	13,390
12	6.31	1,380	6.13	1,250	6.24	1,240	6.70	4,050	4.63	4,612	6.55	12,220
13	6.33	1,410	6.11	1,260	6.32	1,260	6.36	4,140	4.54	4,402	6.43	11,562
14	6.27	1,430	6.09	1,270	6.40	1,280	6.16	4,250	4.47	4,247	6.55	12,220
15	6.28	1,430	6.13	1,280	6.38	1,280	5.76	4,250	4.48	4,268	6.60	12,500
16	6.29	1,430	6.11	1,290	6.36	1,280	5.76	4,440	4.46	4,226	8.40	25,550
17	6.27	1,410	6.14	1,290	6.30	1,270	5.76	8,500	4.41	4,121	9.10	31,580
18	6.26	1,400	6.24	1,300	6.24	1,255	5.76	8,720	4.47	4,247	9.65	36,575
19	6.25	1,380	6.12	1,300	6.25	1,300	5.76	6,700	4.58	4,494	9.98	39,710
20	6.24	1,340	6.32	1,300	6.30	1,330	5.76*b*	4,000	4.73	4,858	10.15	41,325
21	6.24	1,300	6.15	1,300	6.31	1,370	5.21	6,234	5.00	5,600	11.72	56,600
22	6.21	1,250	6.13	1,310	6.34	1,440	5.16	6,076	4.95	5,455	10.88	48,260
23	6.24	1,190	6.30	1,300	6.40	1,510	4.40	4,100	4.84	5,148	9.65	36,575
24	6.20	1,150	6.33	1,280	6.54	1,640	4.05	3,462	4.87	5,229	9.05	31,140
25	6.15	1,130	6.31	1,250	6.54	2,000	4.10	3,545	5.15	6,045	8.73	28,341
26	6.13	1,120	6.27	1,220	6.51	2,380	4.28	3,868	5.56	7,536	8.54	26,716
27	6.11	1,120	6.27	1,180	6.44	2,550	4.35	4,002	5.75	8,335	8.84	29,298
28	6.13	1,150	6.25	1,150	6.43	2,900	4.65	4,660	6.20	10,400	9.36	33,890
29	6.14	1,180	6.23	1,100	6.42	2,950	4.75	4,910	6.55	12,220	9.25	32,905
30	6.14	1,200	.....	.....	6.40	2,950	4.65	4,660	6.70	13,080	9.08	31,404
31	6.15	1,210	.....	.....	6.34	2,950	.....	.....	7.15	16,010	.....	.....

b Ice conditions, January 1 to April 20.

DAILY GAUGE HEIGHT AND DISCHARGE of North Saskatchewan river at Rocky rapids, for 1916
—*Concluded*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	8.54	26,716	7.90	18,300	.....	17,000	.....	7,500	2.65	6,400*e*	5.10	2,830
2	8.86	29,472	7.95	18,950	.....	20,000	.....	7,500	2.63	6,350*e*	5.16	2,890
3	7.91	21,587	8.00	19,200	.....	24,000	.....	7,500	2.49	5,900*e*	5.60	3,190
4	9.65	36,575	8.90	26,460	.....	30,000	.....	7,000	2.46	5,800*e*	5.11	3,010
5	10.24	42,180	8.70	24,940	.....	38,000	.....	7,000	2.43	5,700*e*	5.24	3,020
6	9.26	32,994	.....	22,000*e*	.....	34,000	.....	6,000	2.39	5,600*e*	5.36	3,120
7	8.65	27,650	.....	22,000	.....	32,000	.....	6,000	2.26	5,250*e*	5.56	3,250
8	8.39	25,301	.....	22,000	8.20	22,563*d*	.....	5,800	2.04	5,000	3.34	3,000
9	9.14	31,580	.....	21,000	.....	23,000	.....	6,000	2.10	5,110	3.27	2,680
10	9.79	37,335	.....	21,000	.....	24,000	.....	6,000	2.24	5,450	3.22	2,640
11	9.69	36,195	.....	20,000	.....	18,000	.....	6,000	2.60	5,470	3.11	2,670
12	9.24	31,824	.....	16,000	.....	17,000	.....	5,800	0.62	3,920	3.16	2,710
13	9.09	29,348	.....	15,000	.....	15,000	.....	5,800	0.36	3,570	3.20	2,800
14	9.64	35,118	.....	14,000	.....	12,500	.....	5,800	0.80	3,480	4.32	3,000
15	9.29	31,668	.....	14,000	.....	13,000	.....	5,800	1.51	3,550	4.17	3,120
16	8.29	23,000	.....	15,000	.....	11,000	.....	5,700	1.81	4,060	4.59	3,200
17	8.00	20,600	.....	16,000	.....	11,000	.....	6,000	1.83	4,100	4.56	3,270
18	8.69	24,965	.....	17,000	.....	10,000	.....	7,000	2.01	4,100	5.04	3,277
19	9.09	28,211	8.80	27,108*d*	.....	10,000	.....	10,000	2.42	4,110	4.52	3,230
20	8.39	23,162	.....	27,000	.....	9,000	.....	11,000	4.04	4,190	4.68	2,930
21	7.79	18,374	.....	23,000	.....	9,000	.....	11,000	6.40*a*	4,320	4.92	2,400
22	7.47	15,942	.....	20,000	.....	8,500	.....	11,000	6.87	4,300	5.32	2,030
23	7.14	13,638	.....	17,000	.....	8,500	.....	9,000	7.36	4,190	5.27	2,090
24	6.94	12,332	.....	21,800	.....	8,500	.....	8,500	7.06	3,960	5.29	2,210
25	6.74	11,094	.....	23,000	.....	8,500	.....	8,000	6.13	3,740	5.31	2,390
26	7.39	14,802	.....	22,500	.....	8,500	.....	8,000	4.00	3,070	6.01	2,370
27	9.19	27,515	.....	22,000	.....	8,500	.....	8,000	6.12	3,700	5.55	2,050
28	9.58	31,756	.....	20,000	.....	8,000	.....	7,500*e*	5.68	3,540	5.55	1,940
29	9.30	28,124	.....	18,000	.....	7,800	2.93	7,449	5.73	3,470	5.45	2,010
30	8.60	23,600	.....	18,000	5.87	7,705*d*	2.77	6,800*e*	5.86	3,520	5.34	2,400
31	8.10	19,800	.....	17,000	.....	.....	2.72	6,600*e*	.....	.....	5.37	2,500

a Gauge height interpolated.
d Actual measurement.
e Discharge estimated. Between August 6 and October 28, estimates are based on the discharge at Edmonton. No observer was available at this station.

MONTHLY DISCHARGE of North Saskatchewan river at Rocky rapids, for 1916

(Drainage area 8,149 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	1,430	1,120	1,307	0.160	0.18	80,364
February	1,310	1,100	1,253	0.154	0.17	72,073
March	2,950	970	1,536	0.188	0.22	94,445
April	8,720	2,950	4,436	0.544	0.61	263,960
May	16,010	4,121	7,260	0.891	1.03	446,400
June	56,600	11,562	25,173	3.089	3.45	1,497,897
July	42,180	11,094	26,208	3.216	3.71	1,611,467
August	27,108	14,000	19,976	2.451	2.83	1,228,276
September	38,000	7,705	15,819	1.941	2.17	941,296
October	11,000	5,700	7,324	0.899	1.04	450,335
November	6,400	3,070	4,497	0.552	0.62	267,590
December	3,277	1,940	2,717	0.333	0.38	167,062
The year	.....	.....	.....	.....	16.41	7,121,165

LAKE WABAMUN AT WABAMUN

Location.—On the NE. ¼ Sec. 2, Tp. 53, Rge. 4, W. 5th Mer., at a landing stage in the town of Wabamun.

Records available.—Gauge heights obtained every alternate day from November 10, 1915, to November 26, 1915, and from April 20, 1916, to November 4, 1916.

Gauge.—Vertical metallic staff attached to pile at landing stage; elevation of zero maintained at 93.42 feet.

Bench-mark.—Top of post on jetty marked "B.M."; assumed elevation 97.42 feet. Auxiliary bench-mark; platform of Grand Trunk Pacific railway station at southeast corner of station building; assumed elevation 103.30 feet.

Winter records.—No winter records are being obtained.

Observer.—A. Broadhurst.

DAILY GAUGE HEIGHT, IN FEET, of Lake Wabamun at Wabamun P.O., Province of Alberta, for 1915-1916

DAY	Aug. 1915	Oct. 1915	Nov. 1915	April 1916	May 1916	June 1916	July 1916	Aug. 1916	Sept. 1916	Oct. 1916	Nov. 1916
1		1.64				1.46	1.40		1.68	1.55	
2					1.43			1.78			1.47
3						1.49	1.50		1.72	1.54	
4					1.45		1.87	1.78			1.47*b*
5						1.45	1.65		1.75	1.54	
6					1.43			1.78			
7					1.59	1.43	1.69		1.76	1.53	
8					1.44			1.78			
9	2.29					1.43	1.75		1.75	1.53	
10			1.45		1.43			1.74			
11						1.51	1.75		1.74	1.52	
12			1.45		1.42			1.69			
13						1.47	1.85		1.73	1.50	
14			1.44		1.44			1.69			
15						1.44	1.86		1.73	1.51	
16			1.43		1.45			1.70			
17						1.44	1.84		1.72	1.55	
18			1.425		1.47			1.68			
19						1.34	1.79		1.69	1.56	
20		1.54	1.45	1.35	1.51			1.70			
21						1.42	1.76		1.65	1.54	
22			1.425	1.34	1.47			1.71			
23						1.33	1.70		1.64	1.51	
24			1.425	1.34	1.48			1.70			
25						1.34	1.67		1.63	1.51	
26			1.45*a*	1.35	1.50			1.69			
27						1.34	1.80		1.61	1.54	
28				1.35	1.48			1.66			
29						1.37	1.80		1.59	1.57	
30				1.40	1.48			1.64			
31							1.70			1.48	

a Lake frozen over; ice 9 inches thick at gauge.
b Observations for 1916 ceased.

NORTH SASKATCHEWAN RIVER AT EDMONTON

Location.—On river lot No. 17, NW. ¼ Sec. 33, Tp. 52, Rge. 24, W. 4th Mer., at the low level traffic and railway bridge in the city of Edmonton.

Records available.—May 1, 1911, to December 31, 1916.

Gauge.—Chain gauge on bridge; elevation of zero maintained at 1,991.09 feet from June 28, 1915, to December 31, 1916.

Staff gauge used as a winter gauge on wharf five hundred feet below station; elevation of zero maintained at 1,991.09 feet during the winters of 1915-16 and 1916-17.

Former gauges.—Previous to June 28, 1915, there were two vertical staff gauges.

One low level, reading 0 to 10 feet.

Elevation of zero maintained at 1,991.73 feet during 1911.

Elevation of zero maintained at 1,991.09 feet during 1912, 1913, 1914 and up to June 28, 1915.

One high level, reading 10 to 34 feet.

Elevation of zero maintained at 1,995.67 feet during 1911-12.

Elevation of zero maintained at 1,991.09 feet during 1913, 1914 and up to June 28, 1915.

Bench-mark.—Permanent iron bench-mark on the right bank, ten feet down stream from bridge abutment; elevation 2,037.33 feet (Department of Public Works of Canada datum).

Channel.—One, slightly shifting at all stages.

Discharge measurements.—Made from bridge.

Observer.—J. W. Weir.

Accuracy.—Daily gauge heights are read to one-hundredth of a foot at the same hour daily, from the low level bridge at Edmonton during the open water season by means of a chain gauge, and during winter conditions from a staff gauge on the wharf below the bridge.

The daily discharges are computed from an open water discharge curve in summer. The discharge curve passes through eight out of ten actual metering points and close to the two remaining points, one on each side of the curve.

The curve is smooth and well defined and results are well within the limit of error.

In winter the discharges are computed from actual measurements every three weeks, from gauge heights recorded daily, and from maximum and minimum temperature graphs, and are reasonably fair estimates.

DISCHARGE MEASUREMENTS of North Saskatchewan river at Edmonton, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 13	C. M. O'Neil	328	2,063	0.66	9.45	1,354
Feb. 17	do	320	1,880	0.63	9.38	1,183
Mar. 11	do	320	1,933	0.64	9.17	1,238
April 8	do	340	2,840	1.48	11.20	4,200
April 27	do	439	2,724	1.45	9.15	3,953
May 11	H. S. Kerby	483	3,291	2.06	10.41	6,780
June 1	do	564	5,263	3.21	14.35	17,914
June 17	do	582	6,395	3.83	16.43	24,365*x*
June 17	do	578	6,370	3.81	16.01	24,273
June 22	do	609	10,959	5.61	23.89	61,500*x*
June 28	do	587	6,989	4.20	17.14	29,398
July 15	do	592	7,773	4.49	18.42	34,860
July 28	do	593	7,333	4.36	17.68	31,863
Aug. 22	do	579	6,398	3.52	15.84	22,512
Oct. 10	W. T. Reeve	518	3,166	2.00	10.70	6,361
Nov. 3	do	441	2,980	1.87	10.38	5,559
Nov. 23	C. McGavin	462	3,332	1.08	10.51	3,596
Dec. 21	do	454	2,687	0.82	10.42	2,217

x Slope measurement.

DAILY GAUGE HEIGHT AND DISCHARGE of North Saskatchewan river at Edmonton, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	9.00[b]	1,300	9.36	1,150	9.61	1,000	10.84	3,290	9.94	4,950	15.00	20,200
2	8.90	1,280	9.36	1,170	9.51	980	10.90	3,370	9.74	4,656	15.79	23,379
3	8.80	1,280	9.35	1,170	9.40	970	10.62	3,560	11.67	8,542	14.71	19,040
4	8.84	1,280	9.35	1,180	9.30	950	10.52	3,720	12.83	11,985	14.23	17,120
5	8.78	1,330	9.34	1,170	9.29	960	10.69	3,860	12.07	9,636	14.77	19,280
6	8.72	1,320	9.34	1,160	9.19	970	10.89	3,980	12.06	9,608	15.23	21,120
7	8.66	1,270	9.43	1,160	9.08	1,020	11.01	4,100	12.10	9,720	15.13	20,720
8	8.70	1,260	9.43	1,160	9.08	1,070	11.08	4,200	12.09	9,692	13.76	15,312
9	8.84	1,250	9.42	1,160	9.17	1,130	11.17	4,180	12.13	9,804	13.24	13,424
10	8.90	1,260	9.42	1,160	9.17	1,190	10.99	4,220	12.28	10,232	13.73	15,201
11	9.14	1,275	9.41	1,160	9.16	1,238	11.32	4,260	10.41	5,718	13.66	14,942
12	9.28	1,325	9.41	1,160	9.18	1,300	11.32	4,300	9.61	4,474	13.71	15,127
13	9.35	1,354	9.40	1,160	9.36	1,370	11.42	4,320	9.45	4,275	13.52	14,432
14	9.45	1,400	9.40	1,160	9.37	1,450	11.85	4,700	9.31	4,121	13.63	14,831
15	9.45	1,390	9.39	1,170	9.52	1,550	10.00	5,040	9.26	4,066	13.29	13,604
16	9.44	1,380	9.39	1,170	9.62	1,640	9.95	4,965	9.17	3,970	13.86	15,682
17	9.34	1,370	9.38	1,183	9.62	1,670	10.12	5,232	9.19	3,990	15.89	23,789
18	9.43	1,350	9.38	1,185	9.59	1,680	12.60	11,200	9.20	4,000	18.55	35,665
19	9.43	1,320	9.37	1,190	9.75	1,880	13.00	12,580	9.21	4,011	18.76	36,652
20	9.42	1,270	9.47	1,190	9.63	1,940	11.00[b]	6,920	9.21	4,011	19.27	39,096
21	9.42	1,200	9.56	1,190	9.48	1,900	9.20	4,000	9.47	4,297	21.39	49,272
22	9.41	1,140	9.56	1,190	9.54	1,910	9.11	3,910	9.80	4,740	23.32	58,800
23	9.41	1,080	9.75	1,180	9.64	1,970	9.22	4,022	10.15	5,280	19.90	42,120
24	9.40	1,060	9.65	1,180	9.80	2,120	9.17	3,970	10.12	5,232	17.79	32,195
25	9.40	1,040	9.64	1,170	9.83	2,270	9.17	3,970	9.82	4,770	16.95	28,415
26	9.39	1,030	9.64	1,140	10.03	2,500	9.12	3,920	10.45	5,790	16.61	26,904
27	9.39	1,030	9.73	1,080	10.23	2,930	9.15	3,950	11.55	8,235	16.13	24,799
28	9.38	1,050	9.63	1,040	10.53	3,130	9.27	4,077	11.67	8,542	17.16	29,360
29	9.38	1,070	9.62	1,030	10.63	3,270	9.70	4,600	12.45	10,740	18.34	34,684
30	9.37	1,100	.....	.....	10.63	3,320	9.90	4,890	12.99	12,545	17.87	32,555
31	9.37	1,120	.....	.....	10.67	3,290	.....	.....	13.17	13,175	.....	.....

b Ice conditions, January 1 to April 20.

DAILY GAUGE HEIGHT AND DISCHARGE of North Saskatchewan river at Edmonton, for 1916.—*Concluded.*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	17.54	31,070	16.00	24,240	14.33	17,640	11.44	7,960	10.84	6,552	9.65	2,690
2	15.92	23,912	14.99	20,160	14.26	17,240	11.29	7,596	10.50	5,880	10.00	2,775
3	15.81	23,461	14.94	19,960	15.16*a*	20,340	11.26	7,524	10.38	5,666	10.25	2,855
4	18.13	33,725	16.44	26,554	16.06	24,498	11.23	7,452	10.35	5,635	10.25	2,920
5	21.40	49,320	16.30	25,510	17.49	30,845	11.09	7,127	10.30	5,830	10.09	2,940
6	19.80	41,640	16.20	25,100	19.15	38,520	10.95	6,805	10.25	5,445	10.12	2,920
7	18.94	37,512	15.57	22,480	18.20	34,040	10.65	6,160	10.22	5,394	9.95	2,840
8	18.99	37,752	15.46	22,040	17.82	32,330	10.55	5,970	10.20	5,513	9.74	2,450
9	19.04	37,992	15.51	22,240	16.11	24,713	10.53	5,934	10.30	5,530	9.80	2,430
10	17.94	32,870	15.43	21,920	16.08	24,534	10.71	6,280	10.20	5,513	9.90	2,480
11	17.54	31,070	15.34	21,560	16.02	24,326	10.63	6,120	9.60	3,750	9.95	2,560
12	17.95	32,915	15.12	20,680	14.58	18,520	10.55	5,970	9.59	3,740	9.97	2,650
13	17.97	33,005	14.02	16,280	14.32	17,440	10.47	5,826	9.60	3,710	9.97	2,700
14	18.15	33,815	13.79	15,423	13.82	15,534	10.46	5,808	9.53	3,690	10.05	2,760
15	18.41	35,007	13.52	14,432	13.10	12,930	10.45	5,790	9.98	3,840	10.10	2,825
16	16.99	28,595	13.57	14,612	13.16	13,140	10.44	5,772	10.38	3,845	10.10	2,900
17	15.63	22,723	13.83	15,571	12.72	11,608	10.59	6,042	10.50	3,810	10.20	2,940
18	16.19	25,057	14.03	16,320	12.55	11,045	11.07	7,081	10.51	3,776	10.20	2,930
19	16.74	27,476	14.23	17,120	12.27	10,203	12.21	10,029	10.54	3,730	10.20	2,800
20	17.04	28,820	17.63	31,475	12.16	9,888	12.67	11,438	10.52	3,680	10.32	2,250
21	15.97	24,117	16.23	25,232	12.09	9,692	12.68	11,472	10.51	3,650	10.42	2,217
22	15.98	24,158	15.75	23,215	12.04	9,552	12.63	11,302	10.51	3,620	10.41	2,280
23	15.67	22,887	15.10	20,600	11.80	8,890	11.80	8,890	10.52	3,596	10.41	2,440
24	13.97	16,089	14.77	19,280	11.76	8,782	11.68	8,568	10.52	3,550	10.29	2,510
25	13.37	13,892	15.41	21,840	11.76	8,782	11.52	8,160	10.47	3,525	9.98	2,510
26	13.14	13,070	15.71	23,051	11.78	8,836	11.47	8,035	10.45	3,500	9.98	2,420
27	16.60	26,860	15.65	22,805	11.80	8,890	11.39	7,836	10.45	3,455	9.68	2,100
28	18.28	34,408	15.45	22,000	11.62	8,412	11.25	7,590	10.46	3,420	9.59	2,040
29	18.40	34,960	15.06	20,440	11.47	8,035	11.23	7,452	10.50	3,355	9.57	2,300
30	16.03	24,369	14.55	18,400	11.44	7,960	11.19	7,357	9.50	2,610	9.57	2,350
31	15.98	24,158	14.40	17,800	.....	.....	11.17	7,311	.....	.....	9.43*b*	2,350

a Gauge height interpolated.
b Ice conditions November 11 to December 31.

MONTHLY DISCHARGE of North Saskatchewan river at Edmonton, for 1916

(Drainage area 10,495 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	1,400	1,030	1,232	0.117	0.13	75,753
February	1,400	1,030	1,158	0.110	0.12	66,609
March	3,320	950	1,760	0.168	0.19	108,220
April	12,580	3,290	4,777	0.455	0.51	284,251
May	13,175	3,970	6,929	0.660	0.76	426,048
June	58,800	13,424	25,591	2.438	2.72	1,522,770
July	49,320	13,070	29,249	2.787	3.21	1,798,450
August	26,156	14,432	20,902	1.992	2.30	1,285,214
September	38,520	7,960	16,592	1.581	1.76	987,292
October	11,472	5,772	7,502	0.715	0.82	461,280
November	6,552	2,610	4,293	0.409	0.46	255,451
December	2,940	2,040	2,585	0.246	0.28	158,945
The year	.....	.....	.....	.....	13.26	7,430,283

MEAN MONTHLY DISCHARGE IN Second-feet of North Saskatchewan river at Edmonton

MONTH	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-feet	Mean in Acre-feet
October	.....	6,597	7,162	4,539	4,558	5,673	7,502	6,005	369,242
November	.....	3,723*a*	3,177	2,357	2,473	3,013	4,293	3,063	182,238
December	.....	1,638*b*	1,680	1,058	1,102	1,716	2,585	1,628	100,115
January	.....	1,255	1,393	1,213	1,223	1,232	.....	1,263	77,670
February	.....	1,328	1,313	952	1,079	1,158	.....	1,166	65,742
March	.....	1,316	1,315	1,134	1,677	1,760	.....	1,440	88,567
April	.....	4,629	8,227	2,983	3,323	4,777	.....	4,788	284,894
May	9,238	11,926	9,727	9,064	8,373	6,929	.....	9,210	566,268
June	17,412	18,242	19,780	24,618	39,272	25,591	.....	24,153	1,437,179
July	28,094	34,158	21,439	18,889	42,661	23,249	.....	29,082	1,788,159
August	24,600	26,444	18,505	11,099	23,554	20,902	.....	20,851	1,282,060
September	11,502	12,864	9,430	6,492	10,294	16,592	.....	11,196	666,192
Total in Acre-feet	5,528,580	7,536,081	6,253,951	5,111,452	8,466,780	7,188,222	.....	.....	6,908,326

a 1-10.
b 6-31.

STURGEON RIVER AT ST. ALBERT

Location.—Between river lots 27 and 52, St. Albert settlement, Alberta, at the highway bridge, crossing the Sturgeon river in the village of St. Albert.

Records available.—April 23, 1913, to November 6, 1916.

Gauge.—Vertical staff, fastened to sheet piling on the left bank of the river near the upstream face of the left abutment. Zero elevation maintained at 90.23 feet since establishment.

Bench-mark.—On the cement sill of the east basement window of the St. Albert hotel and marked "B.M., D.I." and a broad arrow in white paint; assumed elevation 100.00 feet.

Channel.—One channel at all stages, fairly permanent.

Control.—Vegetation in bed of stream causes a change of control during the summer.

Discharge measurements.—Made from bridge.

Winter flow.—Stream affected by ice from November to April. Measurements are discontinued during the winter.

Observer.—Lawrence Farrel.

DISCHARGE MEASUREMENTS of Sturgeon river at St. Albert, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 11	C. M. O'Neil	85	373	0.74	4.90	277
May 10	H. S. Kerby	85	216	0.95	2.16	205
June 2	do	85	176	0.79	1.80	139
June 26	do	70	115	0.48	1.02	56
July 15	do	84	181	0.45	1.65	82
July 29	do	85	210	0.48	2.10	93
Aug. 28	do	85	242	0.22	2.49	53
Sept. 15	do	85	307	0.33	3.28	102
Oct. 11	W. T. Reeve	85	282	0.38	2 99	108
Nov. 2	do	85	258	0.38	2.73	98

DAILY GAUGE HEIGHT AND DISCHARGE of Sturgeon river at St. Albert, for 1916

Day	April		May		June		July	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	2.90	312	1.74	137	1.09	57
2	.....	.....	2.70	278	1.76	140	1.07	54
3	.....	.....	2.60	261	1.70	132	1.17	61
4	.....	.....	2.50	244	1.68	130	1.28	69
5	.....	.....	2.43	234	1.64	125	1.37	75
6	.....	.....	2.35	222	1.58	118	1.27	64
7	4.61*b*	280*e*	2.30	215	1.56	116	1.27	64
8	4.71	300	2.28	212	1.55	114	1.28	61
9	4.76	320	2.20	201	1.45	104	1.37	67
10	4.83	360	3.15	194	1.55	114	1.40	68
11	4.90	380	2.12	190	1.53	112	1.46	72
12	4.89	400	2.05	180	1.52	111	1.48	72
13	4.84	420	2.00	173	1.56	116	1.51	72
14	4.73	450	1.98	170	1.56	116	1.61	79
15	4.41*b*	500*e*	1.96	167	1.58	118	1.63	82
16	4.06	547	1.94	165	1.52	111	1.62	76
17	3.91	505	1.90	159	1.55	114	1.76	89
18	3.81	485	1.86	153	1.42	100	1.81	91
19	3.71	465	1.82	148	1.17	73	1.88	97
20	3.56	435	1.81	146	1.11	68	1.86	92
21	3.53	429	1.86	153	1.16	72	1.88	92
22	3.49	421	1.83	149	1.16	72	1.89	90
23	3.42	408	1.78	142	1.10	67	1.98	98
24	3.32	389	1.75	138	1.10	67	1.97	90
25	3.26	377	1.78	142	1.07	64	1.97	90
26	3.16	358	1.77	141	1.02	60	1.97	87
27	3.06	340	1.76	140	0.99*x*	56	2.00	88
28	3.16	358	1.71	133	0.98	53	2.07	94
29	3.26	377	1.68	130	0.93	46	2.10	94
30	3.16	358	1.71	133	1.02	53	2.11	92
31	.....	.....	1.72	135	.....	.....	2.12	90

b Ice conditions from April 7 to April 15.
e Discharge estimated.
x Gauge height affected by weeds, causing shifting conditions from June 27 to end of season.

DAILY GAUGE HEIGHT AND DISCHARGE of Sturgeon river at St. Albert, for 1916—*Concluded*

Day	August		September		October		November	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.16	91	2.50	50	3.18	119	2.76	101
2	2.22	96	49	48	3.15	117	2.73	98
3	2.28	99	2.51	47	3.12	116	2.69	94
4	2.33	101	2.65	60	3.12	117	2.68	92
5	2.36	101	2.75	68	3.13	119	2.67	91
6	2.38	100	2.72	64	3.15	122	2.66*x*	89
7	2.40	99	2.74	64	3.07	114	.....	.....
8	2.42	98	2.73	62	3.05	113	.....	.....
9	2.42	95	2.89	76	3.02	111	.....	.....
10	2.48	98	2.93	78	3.02	112	.....	.....
11	2.48	96	3.00	84	2.97	108	.....	.....
12	2.43	88	3.03	85	2.98	110	.....	.....
13	2.44	86	3.09	90	2.97	109	.....	.....
14	2.47	87	3.16	92	2.97	110	.....	.....
15	2.47	84	3.22	102	2.93	107	.....	.....
16	2.48	82	3.28	99	2.94	109	.....	.....
17	2.48	79	3.31	112	2.89	105	.....	.....
18	2.47	75	3.36	121	2.89	106	.....	.....
19	2.54	79	3.37	125	2.89	106	.....	.....
20	2.55	77	3.41	131	2.88	106	.....	.....
21	2.54	75	3.38	128	2.91	109	.....	.....
22	2.53	71	3.36	127	2.89	108	.....	.....
23	2.52	68	3.34	127	2.87	107	.....	.....
24	2.53	66	3.33	127	2.88	109	.....	.....
25	2.53	63	3.32	127	2.84	105	.....	.....
26	2.52	60	3.31	127	2.88	108	.....	.....
27	2.51	53	3.34	132	2.85	107	.....	.....
28	2.51	53	3.31	130	2.81	104	.....	.....
29	2.49	51	3.24	124	2.79	102	.....	.....
30	2.49	51	3.24	125	2.77	101	.....	.....
31	2.51	52	.....	.....	2.77	102	.....	.....

x Observations discontinued November 6.

MONTHLY DISCHARGE of Sturgeon river at St. Albert, for 1916

(Drainage area 992 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
April (7-30)	547	280	402	0.405	0.36	19,137
May	312	130	179	0.180	0.21	11,006
June	140	46	96	0.097	0.11	5,712
July	98	54	80	0.081	0.09	4,919
August	101	51	80	0.081	0.09	4,919
September	132	47	98	0.099	0.11	5,831
October	122	101	109	0.110	0.13	6,702
November (1-6)	101	89	94	0.095	0.02	1,118
The year	.....	.....	.....	.....	1.12	59,344

STURGEON RIVER NEAR FORT SASKATCHEWAN

Location.—On the NW. ¼ Sec. 28, Tp. 55, Rge. 22, W. 4th Mer., at the steel traffic bridge about five miles north of Fort Saskatchewan and one and one-half miles from the mouth of the river.

Records available.—January 1, 1914, to December 31, 1916. Discharge measurements only in 1913.

Gauges.—Vertical staff fastened to a pile on the left bank of the river. Chain gauge installed on August 20, 1915, on the centre of the bridge, downstream side. Zero elevation of both gauges maintained at 87.52 feet since establishment.

Bench-mark.—Marked with white paint on top of the downstream side of the left abutment; assumed elevation 100.00 feet. Auxiliary bench-mark on downstream side of left wing wall marked "B.M., D.I." and a broad arrow in white paint.

Elevation 96.00 feet referred to assumed bench-mark.

Channel.—One permanent channel at all stages.

Discharge measurements.—Made from bridge.

Winter flow.—Stream affected by ice from November to April.

Observer.—A. McDougall.

DISCHARGE MEASUREMENTS of Sturgeon river near Fort Saskatchewan, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft*
Jan. 17	C. M. O'Neil	40	65	0.93	5.28	60
Feb. 15	do	40	64	0.84	5.45	54
Mar. 4	do	45	65	0.97	5.63	63
Mar. 31	do	63	93	1.02	6.37	95
May 9	H. S. Kerby	72	171	1.42	3.34	243
June 5	do	67	147	0.94	3.16	138
July 8	do	61	131	0.51	2.85	74
July 31	do	67	143	0.63	2.99	90
Aug. 30	do	61	129	0.50	2.85	64
Sept. 16	do	64	139	0.73	2.93	102
Oct. 9	W. T. Reeve	68	146	0.83	3.06	121
Nov. 10	do	71	157	0.45	3.26	71
Dec. 6	C. McGavin	63	118	0.38	3.57	43
Dec. 27	do	42	62	0.29	3.90	18

DAILY GAUGE HEIGHT AND DISCHARGE of Sturgeon river near Fort Saskatchewan, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.80*b*	66	5.40	53	5.40	61	6.30	103	3.54	270	3.00	99
2	4.90	66	5.40	53	5.40	61	6.50	113	3.54	270	3.10	123
3	4.80	65	5.30	51	5.40	62	6.50	126	3.53	266	3.10	123
4	4.80	64	5.10	47	5.40	63	6.20	147	3.53	266	3.10	123
5	4.80	63	5.00	47	5.60	63	6.10	170	3.42	225	3.05	111
6	4.80	63	5.10	50	5.70	63	6.00	200	3.42	225	3.05	111
7	4.80	62	5.20	52	5.90	63	6.00	250	3.36	204	3.00	99
8	4.70	61	5.30	53	5.90	64	6.00	310	3.41	222	3.00	99
9	4.99	61	5.40	53	5.90	66	6.00	350	3.30	184	3.01	101
10	4.99	60	5.40	53	6.00	68	5.90	350	3.30	184	3.01	101
11	4.99	58	5.40	53	6.30	74	5.90	360	3.30	184	3.01	101
12	4.99	58	5.40	54	6.20	73	5.90	410	3.40	218	3.01	101
13	4.99	59	5.50	54	6.20	73	6.00	440	3.40	218	3.02	104
14	5.09	59	5.50	54	6.20	72	6.10	460	3.20	152	3.02	104
15	5.09	59	5.50	54	6.20	72	6.30	470	3.25	168	3.02	104
16	5.08	60	5.40	54	6.00	72	6.80	500	3.30	184	3.02	104
17	5.30	60	5.40	55	6.00	72	7.10	530	3.25	168	2.93	84
18	5.20	61	5.50	55	6.00	72	7.15	600	3.20	152	2.93	84
19	5.20	61	5.50	55	6.00	72	7.20	550	3.20	152	2.93	84
20	5.20	61	5.50	56	6.00	72	4.20	550	3.10	123	2.83	67
21	5.20	60	5.50	56	6.00	72	4.10	504	3.10	123	2.84	68
22	5.20	58	5.50	57	6.00	72	4.09	499	3.15	138	2.74	55
23	5.20	54	5.50	57	6.00	72	4.09	499	3.20	152	2.74	55
24	5.30	54	5.50	58	6.00	75	3.98	449	3.10	123	2.74	55
25	5.30	54	5.40	58	6.00	77	3.88	406	3.10	123	2.74	55
26	5.30	54	5.40	58	6.00	80	3.77	360	3.10	123	2.75	56
27	5.30	53	5.40	59	6.00	83	3.67	320	3.10	123	2.75	56
28	5.40	53	5.40	59	6.00	86	3.66	316	3.10	123	2.75	56
29	5.40	53	5.40	60	6.00	89	3.66	316	3.10	123	2.75	56
30	5.40	53	.....	.....	6.10	92	3.65	312	3.10	123	2.75	56
31	5.40	53	.....	.....	6.30	95	.....	.....	3.00	99	.....	.....

b–b Ice conditions.

DAILY GAUGE HEIGHT AND DISCHARGE of Sturgeon river near Fort Saskatchewan, for 1916 —*Concluded*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1....	2.76	57	2.93	84	2.80	62	3.07	116	3.16	140	3.47	45
2....	2.76	57	2.93	84	2.80	62	3.07	116	3.16	140	3.57	45
3....	2.76	57	2.93	84	2.88	75	3.07	116	3.26	171	3.57	44
4....	2.86	72	2.93	84	3.00	99	3.07	116	3.16	140	3.57	43
5....	2.87	73	2.93	84	3.00	99	3.07	116	3.16	140	3.57	43
6....	2.87	73	2.93	84	3.00	99	3.07	116	3.06	113	3.57	43
7....	2.87	73	2.93	84	2.95	88	3.07	116	3.06	113	3.57	42
8....	2.87	73	2.93	84	2.94	86	3.07	116	3.16*b*	98	3.67	41
9....	2.88	75	2.93	84	2.94	86	3.06	113	3.26	85	3.67	38
10....	2.88	75	2.93	84	2.90	78	3.06	113	3.26	71	3.67	36
11....	2.88	75	2.92	82	2.89	76	3.06	113	3.26	61	3.67	34
12....	2.88	75	2.92	82	2.89	76	3.06	113	3.56	56	3.77	26
13....	2.89	76	2.92	82	2.89	76	3.06	113	3.56	56	3.77	26
14....	2.89	76	2.92	82	2.89	76	3.06	113	3.46	58	3.77	29
15....	2.89	76	2.92	82	2.89	76	3.06	113	3.36	60	3.72	31
16....	2.89	76	2.92	82	2.89	76	3.06	113	3.26	60	3.77	31
17....	2.90	78	2.92	82	2.99	97	3.06	113	3.26	60	3.67	31
18....	2.90	78	2.92	82	3.04	109	3.06	113	3.26	59	3.67	29
19....	2.90	78	2.92	82	3.09	121	3.06	113	3.26	58	3.57	27
20....	2.90	78	2.92	82	3.08	118	3.06	113	3.26	57	3.57	23
21....	2.91	80	2.91	80	3.08	118	3.06	113	3.36	55	3.57	21
22....	3.01	101	2.91	80	3.08	118	3.06	113	3.36	54	3.77	19
23....	3.01	101	2.91	80	3.08	118	3.06	113	3.36	53	3.77	19
24....	3.01	101	2.91	80	3.08	118	3.06	113	3.46	51	3.77	18
25....	3.01	101	2.91	80	3.08	118	3.06	113	3.46	50	3.97	18
26....	3.02	104	2.91	80	3.08	118	3.06	113	3.46	49	3.97	18
27....	3.02	104	2.81	64	3.08	118	3.06	113	3.46	48	3.98	18
28....	3.02	104	2.81	64	3.08	118	3.06	113	3.46	47	3.88	19
29....	3.02	104	2.81	64	3.08	118	3.06	113	3.46	47	3.98	21
30....	3.02	104	2.81	64	3.08	118	3.16	140	3.46	46	3.98	22
31....	3.03	106	2.81	64	.....	.....	3.26	171	.....	.....	4.08*b*	23

b Ice conditions, November 8 to December 31.

MONTHLY DISCHARGE of Sturgeon river near Fort Saskatchewan, for 1916

(Drainage area 1,314 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	66	53	59	0.045	0.05	3,628
February	60	47	54	0.041	0.05	3,106
March	95	61	73	0.056	0.06	4,489
April	600	103	366	0.279	0.31	21,779
May	270	99	174	0.132	0.15	10,699
June	104	55	86	0.065	0.07	5,117
July	106	57	83	0.063	0.07	5,103
August	84	64	79	0.060	0.07	4,858
September	121	62	97	0.074	0.08	5,772
October	171	113	117	0.090	0.10	7,194
November	171	46	77	0.059	0.07	4,582
December	45	18	30	0.023	0.03	1,845
The year	.....	.....	.....	.....	1.11	78,172

HASTINGS CREEK NEAR TOFIELD

Location.—On SE. ¼ Sec. 23, Tp. 51, Rge. 20, W. 4th Mer.

Records available.—From February 14, 1916, to November 11, 1916. Discharge measurements only were made to April 27, 1916, and were made six miles down stream from the established station. Gauge readings were taken daily after April 27, 1916, and records computed.

Gauge.—Vertical staff; zero elevation 87.83 feet.

Bench-mark.—Pile on right bank; assumed elevation 100.00 feet.

Channel.—Permanent; obstructed during summer months by growth of weeds which affects the velocity.

Discharge measurements.—Made by wading.

Winter flow.—Measurements were made in February, March and April, 1916.

Observer.—Miss Alice Wozencroft.

DISCHARGE MEASUREMENTS of Hastings creek near Tofield, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Feb. 14	C. M. O'Neil	5.1	2.46	0.25	.....	0.61*x*
Mar. 3	do	8.1	3.70	0.59	.....	2.20*x*
Mar. 30	do	7.5	5.98	0.56	.....	3.30*x*
April 10	do	16.0	23.45	0.89	.....	21.00*x*
April 28	do	8.6	11.33	1.85	5.00	21.00
June 3	H. S. Kerby	19.0	20.59	0.99	4.96	20.00
June 27	do	15.0	25.00	0.96	5.27	24.00
July 17	do	15.0	13.05	0.62	5.62	8.20
Aug. 1	do	16.0	15.80	0.47	5.57	7.40
Aug. 29	do	15.0	14.50	0.44	5.32	6.30
Nov. 9	W. T. Reeve	18.0	16.80	0.66	4.77	11.00

x Discharge measured on NE. ¼ Sec. 14, Tp. 51, Rge. 19, W. 4th Mer.

DAILY GAUGE HEIGHT AND DISCHARGE of Hastings creek near Tofield, for 1916

Day	April		May		June		July	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			5.02	22.0	5.02	22.0	5.46	24.0
2			5.02	22.0	5.00	21.0	5.49	24.0
3			5.04	22.0	4.95*s*	21.0	5.52	23.0
4			5.05	22.0	5.00	21.0	5.54	25.0
5			5.02	22.0	5.02	22.0	5.56	21.0
6			5.02	22.0	5.00	21.0	5.62	21.0
7			5.12	24.0	4.98	20.0	5.58	19.1
8			4.92	19.2	5.01	21.0	5.57	17.6
9			4.90	18.7	5.04	21.0	5.56	16.2
10			4.92	19.2	5.01	20.0	5.62	16.2
11			4.92	19.2	5.01	20.0	5.63	15.3
12			4.92	19.2	5.07	22.0	5.63	14.0
13			4.92	19.2	5.12	23.0	5.64	13.0
14			4.92	19.2	5.04	21.0	5.72	13.3
15			4.92	19.2	5.04	20.0	5.64	10.6
16			4.90	18.7	5.03	20.0	5.63	9.4
17			4.90	18.7	5.04	20.0	5.62	8.2
18			4.88	18.3	5.05	20.0	5.72	9.8
19			4.87	18.3	5.04	19.9	5.63	8.3
20			4.92	19.2	5.05	19.9	5.63	8.3
21			4.90	18.7	5.04	19.5	5.62	8.2
22			4.92	19.2	5.15	22.0	5.60	7.9
23			4.94	19.7	5.15	22.0	5.62	8.1
24			4.95	19.9	5.16	22.0	5.60	7.9
25			4.95	19.9	5.18	22.0	5.59	7.7
26			4.95	19.9	5.23	23.0	5.62	8.1
27			4.95	19.9	5.25	24.0	5.63	8.3
28	5.00	21.0	4.96	20.0	5.35	25.0	5.54	7.0
29	5.00	21.0	4.96	20.0	5.36	24.0	5.54	7.0
30	5.01	21.0	4.95	19.9	5.45	25.0	5.52	6.7
31			4.99	21.0			5.52	6.7

s Shifting conditions, caused by weeds, June 3 to Nov. 11.

DAILY GAUGE HEIGHT AND DISCHARGE of Hastings creek near Tofield, for 1916—*Concluded*

Day	August		September		October		November	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	5.59	7.7	5.24	5.7	4.97	7.1	4.65	7.8
2	5.61	8.0	5.23	5.6	4.97	7.3	4.62	7.5
3	5.67	9.1	5.23	5.6	4.97	7.4	4.61	7.5
4	5.68	9.3	5.41	8.6	4.97	7.5	4.57	7.2
5	5.70	9.8	5.38	8.4	4.95	7.5	4.57	7.3
6	5.69	9.7	5.33	7.9	4.95	7.5	4.49	6.3
7	5.65	9.2	5.31	7.8	4.92	7.4	4.57	7.6
8	5.61	8.7	5.29	7.6	4.85	6.6	4.60	7.9
9	5.58	8.3	5.34	8.5	4.85	6.7	4.67	9.0
10	5.55	7.9	5.29	7.8	4.85	6.8	4.77	11.0
11	5.55	8.0	5.27	7.8	4.84	6.9	4.79*s*	11.5
12	5.52	7.7	5.27	7.9	4.85	7.0	.....	.....
13	5.49	7.3	5.25	8.0	4.85	7.5	.....	.....
14	5.47	7.1	5.22	7.7	4.82	7.2	.....	.....
15	5.47	7.2	5.21	7.8	4.83	7.5	.....	.....
16	5.50	7.7	5.20	7.8	4.81	7.5	.....	.....
17	5.49	7.7	5.20	7.9	4.81	7.6	.....	.....
18	5.50	7.9	5.21	8.3	4.77	7.4	.....	.....
19	5.53	8.5	5.21	8.4	4.75	7.0	.....	.....
20	5.55	8.9	5.20	8.4	4.81	8.2	.....	.....
21	5.46	7.6	5.17	8.6	4.83	8.8	.....	.....
22	5.40	6.8	5.15	8.5	4.72	7.1	.....	.....
23	5.41	7.1	5.14	8.4	4.72	7.3	.....	.....
24	5.41	7.2	5.13	8.2	4.72	7.5	.....	.....
25	5.41	7.3	5.11	8.2	4.72	7.7	.....	.....
26	5.38	6.9	5.11	8.2	4.72	7.9	.....	.....
27	5.41	7.4	5.07	7.0	4.70	7.7	.....	.....
28	5.41	7.5	5.05	7.9	4.67	7.5	.....	.....
29	5.31	6.2	5.05	8.0	4.67	7.7	.....	.....
30	5.28	6.0	5.06	8.2	4.65	7.5	.....	.....
31	5.29	6.0	.....	.....	4.65	7.6	.....	.....

s Shifting conditions caused by weeds, June 3 to Nov. 11.

MONTHLY DISCHARGE of Hastings creek near Tofield, for 1916

(Drainage area 122 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
April (28-30)	21.0	21.0	21.0	0.173	0.02	125
May	24.0	18.3	20.0	0.164	0.19	1,230
June	25.0	19 5	21.0	0 172	0.19	1,250
July	25.0	6.7	12.9	0.106	0.12	793
August	9.8	6.0	7.8	0.064	0.07	480
September	8.6	5.6	7.8	0.064	0.07	464
October	8.8	6.6	7.4	0.061	0.07	455
November (1-11)	11.5	6.3	8.3	0.068	0.03	181
The period	.....	.....	.....	.....	0.76	4,978

NORTH SASKATCHEWAN RIVER AT BATTLEFORD

Location.—North channel, SW. ¼ Sec. 33, Tp. 43, Rge. 16, W. 3rd Mer. South channel, NE. ¼ Sec. 29, Tp. 43, Rge. 16, W. 3rd Mer.

Records available.—May 16, 1911, to December 31, 1916.

Gauges.—North channel:

Chain; elevation of zero maintained at 1512.30 feet since establishment.

South channel:

Chain; elevation of zero maintained at 1,511.88 feet since establishment.

Bench-mark.—North channel:

On downstream side of left abutment; elevation 1,525.66 feet above mean sea-level (Department of Public Works, Canada).

South channel:

Permanent iron bench-mark on right bank; elevation 1,530.72 feet above mean sea-level (Department of Public Works, Canada).

Channel.—Shifts considerably at high stages.

Discharge measurements.—With current-meter from bridge.

Observers.—H. W. Fisher and W. Bulbick.

DISCHARGE MEASUREMENTS of North channel of North Saskatchewan river at Battleford, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 19-20	F. R. Shenstone	290	1,116	0.28	2.66	314
Feb. 21-22	do	286	1,102	0 31	3.43	345
Mar. 22-23	do	286	1,156	0.33	3.85	380
May 3-4	do	616	1,451	2.01	2.93	2,922
May 29	do	661	2,169	1.58	3.19	3.433
June 19-20	do	1,158	4,366	2.05	5.54	8,963
Sept. 25-26	do	1,068	3.689	1.96	4.88	7.240
Oct. 19-20	do	1,016	2,534	1.70	3 79	4.309
Dec. 8	do	344	1,724	0.84	3 33	1.450
Dec. 27-28	do	343	1,626	0.64	3.82	1,443

DAILY GAUGE HEIGHT AND DISCHARGE of North channel of North Saskatchewan river at Battleford, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.64*a*	510	2.89	300	3.56	390	4.04	460	3.11	3,216	4.12	5,168
2	2.65	500	2.89	310	3.56	390	4.06	470	3.02	3,072	4.36	5,744
3	2.65	490	2.91	310	3.56	390	4.04	490	.....	3,088	4.89	7,152
4	2.65	470	2.91	300	3.59	400	4.04	500	3.04	3,104	5.31	8,369
5	2.65	460	2.94	310	3.60	400	4.04	510	3.30	3,540	6.11	10,730
6	2.65	450	2.94	300	3.60	400	4.07	520	3.32	3,576	6.79	12,829
7	.....	430	2.94	290	3.59	390	4.07	540	3.39	3,702	6.24	11,124
8	.....	420	2.94	280	3.61	390	4.09	560	4.59	6,314	5.93	10,190
9	.....	410	2.96	280	3.61	380	4.19	580	5.28	8,282	6.34	11,434
10	.....	400	2.99	280	3.62	380	4.39	600	5.28	8,282	6.52	11,992
11	.....	390	2.99	260	3.65	390	4.84	700	4.98	7,414	6.20	11,000
12	.....	380	3.04	270	3.65	380	4.79	1,000	4.66	6,508	5.97	10,310
13	.....	370	3.14	280	3.65	380	4.91	1,000	4.45	5,960	5.73	9,590
14	.....	360	3.29	310	3.65	380	5.24	1,300	4.10	5,120	5.60	9,210
15	.....	350	3.44	380	.....	360	4.83	1,400	3.78	4,440	5.65	9,355
16	.....	340	3.44	380	.....	370	4.64	1,500	3.53	3,954	5.91	10,130
17	.....	340	3.44	370	3.65	370	4.79	1,600	3.25	3,450	5.81	9,830
18	2.67	330	3.44	370	3.65	380	4.99	1,800	3.03	3,088	5.55	9,065
19	2.66	320	3.41	360	3.65	380	4.69	1,800	2.93	2,928	5.51	8,949
20	2.66	310	3.41	350	3.65	370	4.17*a*	1,700	2.85	2,800	5.84	9,920
21	2.67	310	3.44	350	3.65	380	4.29	5,576	2.77	2,678	7.74	15,811
22	2.67	300	3.44	340	3.79	380	4.44	5,936	2.72	2,608	8.49	18,222
23	2.68	280	3.39	320	3.92	380	4.52	6,132	2.68	2,552	9.22	20,595
24	2.67	280	3.44	350	3.97	390	5.79	9,770	2.71	2,594	10.26	23,975
25	2.69	280	3.46	360	4.00	400	4.63	6,424	2.68	2,552	10.74	25,535
26	2.69	280	3.49	370	3.99	420	4.24	5,456	2.78	2,692	9.89	22,772
27	2.70	280	3.51	370	4.02	430	4.09	5,098	2.89	2,864	8.49	18,222
28	2.69	260	3.51	380	4.04	440	4.89	7,152	3.13	3,248	7.79	15,968
29	2.74	280	3.54	390	4.04	440	4.79	6,872	3.18	3,328	7.59	15,338
30	2.79	280	.....	.....	4.04	450	3.69	4,260	3.14	3,264	7.51	15,086
31	2.79	280	.....	.....	4.04	450	.....	.....	3.38	3,684	.....	.....

a Ice conditions January 1 to April 20, discharge from winter graph.

DAILY GAUGE HEIGHT AND DISCHARGE of North channel of North Saskatchewan river at Battleford, for 1916.—*Concluded.*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1....	7.39	14,708	8.52	18,320	6.42	11,682	4.66	6,508	4.20	5,360	3.74	1,570
2....	8.39	17,898	8.27	17,508	6.29	11,279	4.64	6,452	4.19	5,336	3.62	1,550
3....	8.38	17,865	7.61	15,402	6.15	10,850	4.61	6,368	4.06	5,032	3.60	1,520
4....	8.24	17,410	7.08	13,732	6.18	10,940	4.46	5,984	4.03	4,966	3.53	1,510
5....	7.64	15,496	6.69	12,519	6.19	10,970	4.35	5,720	3.91	4,702	3.33	1,490
6....	7.24	14,236	6.53	12,023	6.32	11,372	4.26	5,504	3.79	4,460	3.24	1,480
7....	7.34	14,551	6.47	11,837	6.65	12,395	4.25	5,480	3.64	4,160	3.24	1,460
8....	9.08	20,140	6.78	12,798	7.41	14,772	4.24	5,456	3.59	4,062	3.24	1,450
9....	9.88	22,740	7.40	14,740	8.91	19,588	4.17	5,288	3.41	3,738	3.24	1,440
10....	8.65	18,742	7.05	13,638	8.71	18,938	4.08	5,076	3.44	3,792	.....	1,430
11....	8.05	16,792	6.70	12,550	8.18	17,215	4.04	4,988	3.49	3,882	.....	1,420
12....	7.64	15,495	6.50	11,930	7.66	15,559	3.93	4,746	3.59	3,200	.....	1,420
13....	8.33	17,702	6.32	11,372	7.28	14,362	3.88	4,640	3.73	3,000	.....	1,415
14....	8.80	19,230	6.39	11,589	7.30	14,425	3.98	4,856	3.72	2,880	.....	1,410
15....	8.91	19,588	6.65	12,395	7.05	13,638	3.89	4,660	3.59	2,880	.....	1,410
16....	8.30	17,605	6.42	11,682	6.65	12,395	3.85	4,580	3.58	2,870	.....	1,405
17....	8.10	16,955	5.94	10,220	6.20	11,000	3.77	4,420	3.28	2,760	3.19	1,405
18....	8.34	17,735	5.95	10,250	5.99	10,370	3.80	4,480	3.29	2,600	3.23	1,400
19....	8.20	17,280	.....	9,950*e*	5.83	9,890	3.78	4,440	3.20	2,380	3.22	1,400
20....	7.35	14,582	5.75	9,650	5.61	9,239	3.72	4,320	3.36	2,220	3.20	1,400
21....	6.90	13,170	5.96	10,280	5.39	8,601	3.73	4,340	3.37	2,100	3.21	1,400
22....	7.12	13,858	6.23	11,093	5.23	8,137	4.14	5,216	3.16	2,000	3.20	1,400
23....	7.83	16,094	6.41	11,651	5.14	7,876	4.49	6,056	3.16	1,920	3.19	1,400
24....	7.54	15,181	8.10	16,955	5.01	7,499	4.63	6,424	3.24	1,860	3.29	1,405
25....	6.80	12,860	7.56	15,244	4.96	7,348	4.90	7,180	3.35*b*	1,770	3.37	1,410
26....	6.50	11,930	7.00	13,480	4.84	7,012	4.68	6,564	3.59	1,740	3.46	1,420
27....	6.19	10,970	6.59	12,209	4.83	6,984	4.53	6,158	3.94	1,700	3.80	1,430
28....	5.93	10,190	6.42	11,682	4.73	6,704	4.51	6,106	4.00	1,660	3.85	1,443
29....	5.70	9,500	6.74	12,674	4.65	6,480	4.43	5,912	3.87	1,620	3.94	1,460
30....	6.22	11,062	6.71	12,581	4.59	6,314	4.33	5,672	3.87	1,600	4.08	1,470
31....	7.38	14,677	6.64	12,364	.....	.....	4.27	5,528	.....	.....	4.09*b*	1,480

e Discharge estimated.
b Ice conditions November 25 to December 31, discharge from winter graph.

MONTHLY DISCHARGE of North channel of North Saskatchewan river at Battleford, for 1916

MONTH	DISCHARGE IN SECOND-FEET			RUN-OFF
	Maximum	Minimum	Mean	Total in Acre-feet
January	510	260	359	22,074
February	390	260	328	18,867
March	450	360	395	24,288
April	9,770	460	2,723	161,991
May	8,282	2,552	3,997	245,708
June	25,535	5,168	12,787	760,699
July	22,740	9,500	15,685	964,204
August	18,320	9,650	12,720	781,936
September	19,588	6,314	11,128	662,005
October	7,180	4,320	5,456	335,397

DISCHARGE MEASUREMENTS of South channel of North Saskatchewan river at Battleford, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 20-21	F. R. Shenstone	172	670	1.27	3.98*b*	850
Feb. 23-24	do	169	597	1.32	4.49*b*	790
Mar. 23-24	do	169	551	1.80	4.94*b*	992
May 4-5	do	297	1,239	2.80	4.11	3,468
May 30	do	314	1,393	2.38	4.23	3,325
June 20	do	545	2,854	2.64	6.77	7,531
Sept. 26	do	346	2,858	2.00	6.04	5,713
Oct. 20-21	do	288	2,303	1.58	4.92	3,630
Dec. 9	do	188	1,164	1.14	4.55*b*	1,328
Dec. 27-28	do	184	1,090	1.06	5.16*b*	1,151

b Ice conditions.

DAILY GAUGE HEIGHT AND DISCHARGE of South channel of North Saskatchewan river at Battleford, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.13*b*	1,050	4.15	830	4.55	820	4.85	1,160	4.24	3,388	5.07	3,850
2	4.13	1,050	4.20	840	4.55	830	4.80	1,160	4.10	3,360	5.40	4,280
3	4.10	1,040	4.20	830	4.54	830	4.78	1,180	.....	3,357*e*	5.91	5,284
4	4.10	1,040	4.25	840	4.57	840	4.76	1,200	4.05	3,355	6.40	6,540
5	4.10	1,020	4.25	830	4.56	840	4.75	1,220	4.25	3,390	7.14	8,660
6	4.10	1,010	4.27	830	4.58	840	4.75	1,250	4.35	3,410	7.80	10,700
7	.....	1,000	4.27	820	4.58	840	4.48	1,270	4.42	3,428	7.19	8,810
8	.....	990	4.30	820	4.59	840	4.80	1,280	5.50	4,440	6.93	8,030
9	.....	980	4.30	820	4.64	860	4.80	1,300	6.25	6,150	7.26	9,020
10	.....	970	4.32	820	4.67	870	4.80	1,300	6.20	6,020	7.56	9,932
11	.....	960	4.32	810	4.69	880	4.80	1,500	5.90	5,260	7.20	8,840
12	.....	950	4.35	820	4.70	880	5.75	1,700	5.61	4,660	6.93	8,030
13	.....	940	4.40	830	4.69	880	6.46	1,800	5.41	4,296	6.79	7,632
14	.....	920	4.45	840	4.69	880	6.23	2,000	5.10	3,880	6.64	7,212
15	.....	920	4.45	830	.....	880	6.06	2,300	4.93	3,724	6.64	7,212
16	.....	900	4.47	830	.....	880	6.10	2,600	4.65	3,530	6.79	7,632
17	.....	890	4.45	820	4.70	880	5.80	2,800	4.46	3,444	6.85	7,800
18	3.94	860	4.45	810	4.70	880	5.00	3,200	4.30	3,400	6.54	6,932
19	3.97	860	4.43	800	4.70	880	4.90	3,600	4.17	3,374	6.64	7,212
20	3.98	850	4.50	810	4.72	880	5.50*b*	3,800	4.12	3,364	6.83	7,744
21	3.98	850	4.55	820	4.72	890	5.28	4,112	4.07	3,357	8.75	14,050
22	3.98	840	4.51	800	4.74	900	5.32	4,168	4.01	3,351	9.45	16,800
23	3.98	840	4.50	790	4.90	960	5.40	4,280	3.96	3,346	10.08	19,320
24	4.00	830	4.50	790	4.98	1,020	6.80	7,660	3.96	3,346	11.11	23,440
25	4.00	830	4.49	800	5.03	1,050	5.66	4,760	3.95	3,345	11.86	26,440
26	4.00	820	4.51	800	5.05	1,080	5.07	3,850	3.99	3,349	10.64	21,560
27	4.05	820	4.51	800	4.98	1,110	4.95	3,740	4.00	3,350	9.28	16,120
28	4.05	820	4.54	810	4.90	1,120	5.60	4,640	4.25	3,390	8.74	14,012
29	4.15	850	4.54	820	4.90	1,140	5.54	4,520	4.35	3,410	8.48	13,048
30	4.12	840	.....	.....	4.88	1,140	4.70	3,560	4.33	3,406	8.39	12,724
31	4.10	820	.....	.....	4.85	1,150	.....	.....	4.52	3,468	.....	.....

b Ice conditions January 1 to April 20: discharge from winter graph.
e Discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of South channel of North Saskatchewan river at Battleford, for 1916.—*Concluded.*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1....	8.29	12,364	9.51	17,040	7.52	9,804	5.80	5,040	5.32	4,168	4.90	1,450
2....	9.18	15,720	9.31	16,240	7.38	9,380	5.77	4,980	5.32	4,168	4.76	1,440
3....	9.14	15,560	8.72	13,936	7.24	8,960	5.74	4,920	5.21	4,014	4.76	1,420
4....	8.86	14,668	8.18	11,992	7.26	9,020	5.60	4,640	5.17	3,964	4.70	1,410
5....	8.54	13,264	7.79	10,668	7.28	9,080	5.49	4,424	5.07	3,850	4.50	1,390
6....	8.41	12,796	7.64	10,188	7.43	9,530	5.39	4,266	4.93	3,724	4.43	1,370
7....	8.38	12,688	7.59	10,028	7.76	10,572	5.38	4,252	4.77	3,602	4.55	1,350
8....	9.92	18,680	7.88	10,972	8.51	13,156	5.36	4,224	4.77	3,602	4.40	1,340
9....	10.65	21,600	8.59	13,444	9.79	18,160	5.30	4,140	4.75	3,590	4.55	1,328
10....	9.56	17,240	8.15	11,890	9.79	18,160	5.21	4,014	4.65	3,530	4.54	1,300
11....	9.07	15,280	7.91	11,074	9.26	16,040	5.17	3,964	.....*g*	3,543	4.55	1,290
12....	8.69	13,822	7.79	10,668	8.76	14,088	5.07	3,850	.....	3,400	4.56	1,280
13....	9.36	16,440	7.44	9,560	8.37	12,652	5.02	3,800	.....	3,000	4.32	1,270
14....	9.94	18,760	7.47	9,650	8.38	12,688	5.13	3,916	.....	2,600	4.16	1,255
15....	10.04	19,160	7.76	10,572	8.14	11,856	5.10	3,880	.....*g*	2,590	4.17	1,250
16....	9.29	16,160	7.54	9,868	7.74	10,508	4.96	3,748	4.78	2,580	4.19	1,240
17....	9.11	15,440	7.03	8,330	7.30	9,140	4.90	3,700	4.60	2,570	4.10	1,230
18....	9.48	16,920	7.05	8,390	7.08	8,480	4.98	3,764	4.60	2,560	4.11	1,220
19....	9.29	16,160	.....	8,053*e*	6.91	7,970	4.95	3,740	4.59	2,440	4.19	1,210
20....	8.51	13,156	6.82	7,716	6.70	7,380	4.93	3,724	4.78	2,300	4.30	1,200
21....	7.99	11,346	7.11	8,570	6.50	6,820	4.92	3,716	4.77	2,080	4.37	1,195
22....	8.30	12,400	7.35	9,290	6.34	6,384	5.30	4,140	4.35	1,900	4.36	1,185
23....	8.85	14,430	7.51	9,772	6.23	6,098	5.67	4,780	4.40	1,800	4.32	1,180
24....	8.55	13,300	9.20	15,800	6.11	5,786	5.80	5,040	4.60	1,700	4.40	1,170
25....	7.98	11,312	8.64	13,632	6.05	5,630	6.10	5,760	4.84	1,625	4.50	1,165
26....	7.57	9,964	8.10	11,720	6.04	5,604	5.84	5,128	4.90	1,600	4.57	1,160
27....	7.25	8,990	7.70	10,380	5.96	5,404	5.70	4,840	4.91	1,560	4.90	1,150
28....	6.99	8,210	7.53	9,836	5.87	5,194	5.67	4,780	5.02	1,530	5.15	1,151
29....	6.83	7,744	7.84	10,836	5.77	4,980	5.57	4,580	5.14	1,500	5.20	1,145
30....	7.29	9,110	7.81	10,734	5.72	4,880	5.46	4,376	5.15*b*	1,480	5.27	1,140
31....	8.44	12,904	7.75	10,540	.....	.....	5.40	4,280	.....	.....	5.37*b*	1,140

b Ice conditions November 30 to December 31.
e Discharge estimated.
g Blocked with slush ice November 11 to November 15.

MONTHLY DISCHARGE of South channel of North Saskatchewan river at Battleford, for 1916

MONTH	DISCHARGE IN SECOND-FEET			RUN-OFF
	Maximum	Minimum	Mean	Total in Acre-feet
January	1,050	820	915	56,261
February	840	790	818	47,052
March	1,150	820	928	57,060
April	7,660	1,160	2,764	164,469
May	6,150	3,345	3,753	230,763
June	26,440	3,850	10,962	652,289
July	21,600	7,744	14,051	863,962
August	17,044	7,716	11,013	677,163
September	18,160	4,880	9,447	562,136
October	5,760	3,716	4,336	266,611

MONTHLY DISCHARGE of North Saskatchewan river at Battleford, for 1916

(Drainage area 27,100 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	1,560	1,080	1,274	0.047	0.05	78,335
February	1,210	1,070	1,146	0.042	0.04	65,919
March	1,600	1,210	1,323	0.049	0.06	81,348
April	17,430	1,620	5,487	0.202	0.22	326,460
May	14,432	5,897	7,750	0.286	0.33	476,471
June	51,975	9,018	23,749	0.877	0.98	1,412,988
July	44,340	17,244	29,736	1.100	1.27	1,828,166
August	35,360	17,366	23,733	0.876	1.01	1,459,099
September	37,748	11,194	20,575	0.759	0.85	1,224,141
October	12,940	8,044	9,792	0.361	0.42	602,008
November	9,528	3,080	5,828	0.211	0.24	346,730
December	3,020	2,540	2,701	0.100	0.12	166,079
The year					5.59	8,067,744

The drainage area given in this table is only approximate. It must be remembered that the greater part of the run-off at this station is derived from the eastern slope of the Rocky mountains and must not be used to base estimates of run-off on other streams in the same territory.

MEAN MONTHLY DISCHARGE in Second-feet of North Saskatchewan river at Battleford

MONTH	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	8,100	6,432	6,942	.....	9,792	7,816	480,599
November	.....	3,874	3,706	4,199	.....	5,828	4,402	261,909
December	.....	1,944	2,161	1,718	1,850	2,701	2,075	127,575
January	1,284	1,220	1,193	1,677	1,274	.....	1,330	81,753
February	1,400	1,553	1,132	1,467	1,146	.....	1,340	75,407
March	1,448	1,963	1,299	1,742	1,323	.....	1,555	95,614
April	8,405	9,621	3,456	7,477	5,487	.....	6,889	409,940
May	11,900	9,664	12,180	5,035*a*	7,750	.....	10,376	637,966
June	16,738	19,941	31,046	.....	23,749	.....	22,868	1,360,052
July	33,851	23,104	25,907	.....	29,736	.....	28,150	1,730,780
August	27,019	21,631	13,675	.....	23,733	.....	21,514	1,322,840
September	17,381	11,874	8,589	.....	20,575	.....	14,605	869,008
Total in acre-feet.	7,253,353	6,940,546	6,709,631	1,618,879	7,066,680	.....	.....	7,453,443

a 1-10

No discharge estimates made between May 10 and December 1, 1915, owing to rapidly shifting conditions in channels, and the fact that measurements were not secured frequently enough to follow changes which it is believed occurred owing to unusually high stages.

PIGEON CREEK NEAR WESTEROSE

Location.—On the SE. ¼ Sec. 15, Tp. 46, Rge. 28, W. 4th Mer., at the traffic bridge near outlet of Pigeon lake and on the trail from Wetaskiwin to Westerose post office.

Records available.—Discharge measurements only made during 1912, 1913 and 1914. Gauge readings every three days, March 24, 1915, to October 31, 1915, and from March 22, 1916, to October 31, 1916, and records computed for those periods.

Gauge.—Vertical staff, spiked to a post in creek on downstream side of bridge. Zero elevation maintained at 93.36 feet.

Bench-mark.—Permanent iron bench-mark at southwest corner of bridge; assumed elevation 100.23 feet.

Channel.—Permanent; sand and gravel.

Discharge measurements.—Made by wading near the bridge.

Winter flow.—No records taken during the winter.

Observer.—L. I. Wood takes readings at intervals of two or three days. All intermediate readings are interpolated from the observed readings, which were discontinued on October 31, 1916.

Discharge Measurements of Pigeon creek near Westerose, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 18	O. H. Hoover	30	43.20	1.90	4.36	82.0
May 12	C. M. O'Neil	38	60.15	1.63	4.43	98.0
June 7	H. S. Kerby	47	74.25	1.29	4.66	96.0
July 19	do	48	93.90	1.29	5.00	120.0
Aug. 9	do	19	9.05	1.16	2.87	9.2*x*
Sept. 17	do	18	6.65	0.88	2.75	5.8*x*

x Dam at outlet of lake closed.

Daily Gauge Height and Discharge of Pigeon creek near Westerose, for 1916

Day	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			2.39	1.12	4.15*a*	67	4.62*a*	95
2			2.38*a*	1.04	4.20*a*	70	4.65	97
3			2.36*a*	0.88	4.26*a*	74	4.65*a*	97
4			2.35	0.80	4.32*a*	77	4.65*a*	97
5			2.35*a*	0.80	4.38	81	4.65*a*	97
6			2.35	0.80	4.36*a*	80	4.65*a*	97
7			4.15*x*	67.00	4.34*a*	78	4.65	97
8			3.89*a*	52.00	4.32*a*	77	4.73*a*	102
9			3.64*a*	40.00	4.30	76	4.81*a*	107
10			3.38*a*	27.00	4.33*a*	78	4.89	112
11			3.12	17.10	4.37*a*	80	4.88*a*	111
12			3.57*a*	36.00	4.40	82	4.87*a*	111
13			3.95	56.00	4.41	83	4.87*a*	111
14			4.13*a*	66.00	4.41*a*	83	4.86	110
15			4.32	77.00	4.40*a*	82	4.83*a*	108
16			4.33*a*	78.00	4.40*a*	82	4.79*a*	105
17			4.35*a*	79.00	4.40	82	4.76	104
18			4.36	80.00	4.39*a*	81	4.75*a*	103
19			4.36	80.00	4.37	80	4.73	102
20			4.35*a*	79.00	4.40*a*	82	4.71*a*	101
21			4.33*a*	78.00	4.43*a*	84	4.69*a*	99
22	2.37	0.96	4.32	77.00	4.46*a*	86	4.67*a*	98
23	2.37*a*	0.96	4.30	76.00	4.49*a*	87	4.65	97
24	2.38*a*	1.04	4.20*a*	70.00	4.52	89	4.63*a*	96
25	2.39	1.12	4.10*a*	64.00	4.55*a*	91	4.60	94
26	2.39*a*	1.12	4.01*a*	59.00	4.57*a*	92	4.59*a*	93
27	2.39*a*	1.12	3.92	54.00	4.60	94	4.58	93
28	2.40*a*	1.20	3.98*a*	57.00	4.58*a*	93	4.58*a*	93
29	2.40	1.20	4.03*a*	60.00	4.56	92	4.58*a*	93
30	2.40*a*	1.20	4.09*a*	63.00	4.58*a*	93	4.58*a*	93
31	2.39*a*	1.12			4.60*a*	94		

a Gauge height interpolated.
x Sluice-way opened April 7.

DAILY GAUGE HEIGHT AND DISCHARGE of Pigeon creek near Westerose, for 1916—*Concluded*

Day	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.58	93	3.51*a*	34.0	2.75	6.1	2.63*a*	4.0
2	4.67*a*	98	3.50*a*	33.0	2.73*a*	5.7	2.56*a*	3.0
3	4.76*a*	104	3.50	33.0	2.71*a*	5.2	2.59	3.4
4	4.85*a*	110	3.55*a*	36.0	2.69*a*	4.8	2.64*a*	4.1
5	4.95	116	3.60	38.0	2.67*a*	4.6	2.58*a*	3.2
6	4.98*a*	118	3.56*a*	36.0	2.65	4.2	2.51*a*	2.3
7	5.00*a*	120	2.91*x*	10.1	2.74	5.9	2.65	4.2
8	5.02	121	2.89*a*	9.5	2.79*a*	7.0	2.84*a*	8.0
9	5.00	120	2.87	9.0	2.83	8.0	2.83*a*	8.0
10	4.98*a*	118	2.86*a*	8.8	2.77*a*	6.5	2.82*a*	7.7
11	4.96*a*	117	2.85*a*	8.5	2.72*a*	5.4	2.90	9.8
12	4.94	116	2.84	8.2	2.66*a*	4.4	2.98*a*	12.4
13	4.94*a*	116	2.84*a*	8.2	2.60	3.5	2.95	11.4
14	4.95*a*	116	2.84	8.2	2.70	5.0	2.95*a*	11.4
15	4.95	116	2.81*a*	7.5	2.80*a*	7.2	2.94*a*	11.1
16	5.01*a*	121	2.78	6.8	2.79*a*	7.0	2.94	11.1
17	5.08	126	2.79*a*	7.0	2.78*a*	6.8	2.94*a*	11.1
18	5.05*a*	124	2.81*a*	7.5	2.78	6.8	2.94*a*	11.1
19	5.01*a*	121	2.82*a*	7.7	2.74*a*	5.9	2.94*a*	11.1
20	4.98*a*	118	2.84*a*	8.2	2.69*a*	4.8	2.94*a*	11.1
21	4.95	116	2.85	8.5	2.65	4.2	2.94	11.1
22	4.89*a*	112	2.85*a*	8.5	2.63*a*	4.0	2.95*a*	11.4
23	4.82*a*	107	2.85*a*	8.5	2.60	3.5	2.96*a*	11.7
24	4.76*a*	104	2.85	8.5	2.76*a*	6.3	2.97*a*	12.0
25	4.69*a*	99	2.83*a*	8.0	2.92*a*	10.4	2.98	12.4
26	4.63	96	2.81*a*	7.5	3.08	15.7	2.98*a*	12.4
27	4.06*a*	62	2.79*a*	7.0	2.40	1.2	2.98*a*	12.4
28	3.50	33	2.77*a*	6.5	2.64	4.1	2.98	12.4
29	3.51*a*	34	2.75	6.1	2.77*a*	6.5	3.08*a*	15.7
30	3.52	34	2.75*a*	6.1	2.70*a*	5.0	3.18*a*	19.3
31	3.51*a*	34	2.75*a*	6.1	.....	.....	3.27	23.0

a Gauge height interpolated.
x Sluice-way closed Aug. 7.

MONTHLY DISCHARGE of Pigeon creek near Westerose, for 1916

(Drainage area 120 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (22-31)	1.20	0.96	1.10	0.009	0.01	22
April	80.00	0.80	50.00	0.417	0.46	2,975
May	94.00	67.00	83.00	0.691	0.80	5,103
June	112.00	93.00	100.00	0.833	0.93	5,950
July	126.00	33.00	101.00	0.841	0.97	6,215
August	38.00	6.10	13.10	0.109	0.13	806
September	15.70	1.20	5.90	0.049	0.06	351
October	23.00	2.30	10.10	0.084	0.10	621
The period	.....	.....	.....	.....	3.46	22,043

BATTLE RIVER AT PONOKA

Location.—On the SW. ¼ Sec. 4, Tp. 43, Rge. 25, W. 4th Mer., at the steel traffic bridge, 300 yards SE. of the C.P.R. depot in the town of Ponoka.

Records available.—May 7, 1913, to December 31, 1916.

Gauge.—Vertical staff; zero elevation maintained at 88.31 since establishment.

Bench-mark.—Permanent iron bench-mark located beside outside pile on upstream side of left abutment; assumed elevation 100.00 feet.

Channel.—One; slightly shifting.

Discharge measurements.—Made from bridge, and in low stages by wading at a point 300 feet up stream.

Winter flow.—Stream affected by ice from November to April.

Observer.—W. Steadman.

DISCHARGE MEASUREMENTS of Battle river at Ponoka, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 12	C. M. O'Neil	53	60	0.14	2.49	8.4
Jan. 19	do	50	42	0.15	3.31	6.4
Feb. 16	do	38	28	0.23	2.20	6.4
Mar. 10	do	33	26	0.41	3.20	10.7
April 1	do	80	349	1.34	8.08	469.0
April 7	do	78	233	1.27	6.27	296.0
April 19	O. H. Hoover	71	276	0.87	4.25	239.0
May 13	C. M. O'Neil	107	141	1.45	3.93	204.0
June 9	H. S. Kerby	77	258	1.53	5.07	394.0
June 29	do	70	190	1.35	4.18	258.0
July 20	do	81	312	1.49	5.65	465.0
Aug. 11	do	69	160	1.21	3.88	193.0
Sept. 1	do	71	183	1.21	4.05	221.0
Sept. 19	do	78	391	1.10	5.50	432.0
Oct. 16	W. K. Broughton	69	226	0.70	3.75	159.0
Nov. 10	do	70	223	0.40	3.65	89.0
Nov. 30	W. T. Reeve	68	180	0.54	3.79	98.0
Dec. 21	do	66	155	0.39	3.75	60.0

DAILY GAUGE HEIGHT AND DISCHARGE of Battle river at Ponoka, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.90*ab*	11.7	2.22	6.3	4.25	29.0	8.08	469	4.08	220	5.28	395
2	2.96*a*	11.1	2.20	6.3	4.25	29.0	8.13	440	4.24	239	5.03	354
3	3.01*a*	10.7	2.20	6.3	4.20	29.0	7.80	396	4.49	271	5.12	368
4	3.07	10.0	2.20	6.2	3.90	29.0	7.47	370	4.33	250	5.04	355
5	3.04	11.0	2.20	6.2	3.65	27.0	7.24	340	4.15	228	5.38	412
6	2.89	10.7	2.15	6.2	3.40	23.0	6.79	310	4.07	218	5.62	454
7	2.84	10.2	2.17	6.2	3.20	20.0	6.34	296	3.98	208	5.48	429
8	2.84	9.6	2.20	6.2	3.12	13.2	6.27	292	3.85	192	5.24	388
9	2.94	9.4	2.15	6.1	3.05	11.0	5.86	288	3.70	176	5.08	362
10	2.69	9.1	2.18	6.1	3.10	10.7	6.04	282	3.76	183	5.40	415
11	2.59	9.0	2.20	6.1	3.65	11.1	5.95	278	3.78	185	6.42	600
12	2.49	8.4	2.20	6.1	4.55	13.2	5.35	272	3.83	190	6.75	662
13	2.34	8.2	2.20	6.2	4.60	19.6	4.73	269	3.95	204	6.68	649
14	2.43	8.1	2.00	6.3	4.70	23.0	4.21	264	3.95	204	6.25	568
15	2.34	7.8	2.20	6.3	4.80	29.0	4.63*b*	260	3.95	204	5.70	468
16	2.29	7.5	2.15	6.4	5.11	34.0	4.33	250	3.96	205	5.31	400
17	2.34	7.2	2.15	6.4	4.98	39.0	4.28	244	3.90	198	5.13	370
18	2.29	6.9	2.15	6.3	4.85	42.0	4.27	242	3.84	191	5.10	365
19	2.34	6.4	2.15	6.3	4.70	46.0	3.94	203	3.75	182	4.98	346
20	2.29	6.4	2.15	6.3	4.69	48.0	4.16	229	3.75	182	4.84	323
21	2.29	6.4	2.15	6.4	4.98	55.0	4.06	217	3.70	176	4.84	323
22	2.34	6.4	2.15	6.4	5.46	145.0	4.00	210	3.75	182	4.66	295
23	2.34	6.4	2.15	6.5	6.50	275.0	3.90	198	3.80	187	4.44	264
24	2.34	6.4	3.35	10.0	7.65	395.0	3.80	187	3.99	209	4.28	244
25	2.29	6.4	3.80	17.0	7.90	425.0	3.71	177	4.85	325	4.15	228
26	2.24	6.4	3.65	22.0	8.38	510.0	3.79	186	5.09	363	4.03	214
27	2.34	6.4	4.20	27.0	8.40	508.0	3.67	173	5.04	355	4.01	211
28	2.29	6.3	4.20	29.0	8.20	504.0	3.71	177	4.82	320	4.06	217
29	2.29	6.3	4.20	29.0	8.01	492.0	3.85	192	4.69	300	4.18	232
30	2.26	6.3	.....	.....	8.04*a*	480.0	3.94	203	4.45	265	4.20	234
31	2.22	6.3	.....	.....	8.06*a*	472.0	.....	.....	4.70	301	.....	.....

a Gauge height interpolated.
b Ice conditions, Jan. 1 to April 15.

DAILY GAUGE HEIGHT AND DISCHARGE of Battle river at Ponoka, for 1916—*Concluded*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.24	239	4.43	262	4.04	215	4.31	247	4.11	223	3.77	98
2	4.32	248	4.27	242	4.41	259	4.19	233	4.07	218	3.76	96
3	4.51	273	4.67	296	4.64	292	4.10	222	4.02	212	3.67	91
4	6.10	540	4.61	288	7.23	756	4.11	223	4.06	217	3.56	86
5	7.61	832	5.16	375	9.42	1,225	4.11	223	3.91	199	3.59	83
6	8.16	948	5.16	375	9.93	1,344	4.05	216	3.85	192	3 54	80
7	8.57	1,037	4.86	327	12.26	1,930	4.02	212	3.71	177	3.54	76
8	9.10	1,154	4.45	265	12.87	2,080	3.99	209	3.73*b*	160	3.57	73
9	9.24	1,185	4.26	241	12.53	1,994	3.94	203	3.91	140	3.67	66
10	8.94	1,119	4.15	228	12.01	1,864	3.89	197	3.70	89	3.67	60
11	7.97	908	3.80	187	12.47	1,980	3.87	195	3.65	89	3.69	59
12	6.99	708	3.66*a*	172	12.02	1,867	3.82	189	3.67	89	3.72	59
13	6.60	634	3 51	157	11.12	1,642	3.76	183	3.75	90	3.72	61
14	6.53	621	3.40	146	9.80	1,312	3.85	192	3.72	91	3.73	64
15	6.39	594	3.26	132	8.28	974	3.75	182	3.64	92	3.74	65
16	6.06	533	3.19	125	7.00	710	3.75	182	3.66	93	3.75	65
17	5.57	445	3.18	124	6.38	592	3.90	198	3.68	93	3.77	65
18	5.48	429	3.25	131	6.01	524	4.25	240	3.74	94	3.78	64
19	5.73	473	5.02	352	5.52	436	4.50	272	3.76	94	3.81	63
20	5.65	459	6.54	623	5.18	378	4.58	283	3.87	95	3.77	62
21	5.53	437	6.56	626	4.86	327	4.90	333	3.92	95	3.75	60
22	5.08	362	6.30	577	4.64	292	5.01	351	3.95	96	3.78	58
23	4.91	335	6.00	522	4.42	261	5.16	375	3.98	96	3.78	55
24	4.78	314	5.71	470	4.30	246	5.01	351	4.00	96	3.77	54
25	4.71	303	5.36	408	4.24	239	4.87	328	3.91	96	3.78	52
26	4.72	304	5.12	368	4.48	269	4.73	306	3.99	97	3.82	50
27	4.82	320	4.75	309	4.42	261	4.61	288	3 99	97	3.82	49
28	5.05	357	4.35	252	4.24	239	4.46	266	3.94	98	3.79	49
29	5.23	386	4.07	218	4.21	235	4.27	242	3.90	98	3.80	49
30	5.41	417	3.88	196	4.20	234	4.06	217	3.79	98	3.80	49
31	4.86	327	3.79	186	.....	.....	4.22	236	.....	.....	3.78*b*	50

a Gauge height interpolated.
b Ice conditions, Nov. 8 to December 31.

MONTHLY DISCHARGE of Battle river at Ponoka, for 1916

(Drainage area 661 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	11.7	6.3	8.0	0.012	0.01	492
February	29.0	6.1	8.8	0.013	0.01	506
March	510.0	10.7	35.0	0.053	0.06	2,152
April	469.0	173.0	264.0	0.399	0.45	15,709
May	363.0	176.0	229.0	0.346	0.40	14,081
June	662.0	211.0	372.0	0.561	0.63	22,136
July	1,185.0	239.0	556.0	0.841	0.97	34,187
August	626.0	124.0	296.0	0.448	0.52	18,200
September	2,080.0	215.0	833.0	1.260	1.41	49,567
October	375.0	182.0	245.0	0.371	0.43	15,064
November	223.0	89.0	124.0	0.188	0.21	7,379
December	98.0	49.0	65.0	0.098	0.11	3,997
The year	.....	.....	.....	.....	5.21	183,470

BATTLE RIVER AT BATTLEFORD

Location.—On the NW. ¼ Sec. 25, Tp. 43, Rge. 17, W. 3rd Mer., at the traffic bridge about one mile west of the Canadian Northern railway station at Battleford.

Records available.—June 17, 1911, to December 31, 1916.

Gauge.—Chain gauge, 200 feet from initial point of soundings; zero elevation maintained at 83.89 feet since establishment (May 23, 1914).

Bench-mark.—On top of abutment, downstream side of west end of bridge; assumed elevation 100.00 feet.

Channel.—Permanent.

Discharge measurements.—From bridge.

Observer.—R. L. Robson.

DISCHARGE MEASUREMENTS of Battle river at Battleford, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 21, 22	F. R. Shenstone	106	40.4	0.93	3.37	38
Feb. 24, 25	do	30	17 9	1.43	3.43	26
Mar. 24	do	32	19.5	1.18	3.63	23
May 2	do	200	562.0	2.24	5.35	1,258
May 27	do	201	457.0	1.69	4.47	777
June 21	do	206	835.0	2.41	6.77	2,007
July 12	F. R. Shenstone and J. R. Estey	207	845.0	2.41	6.84	2,038
Aug. 5	J. R. Estey	205	614.0	2.49	5.89	1,529
Aug. 30	F. R. Shenstone	204	627.0	2.17	5.64	1,359
Sept. 23	do	207	863.0	2.45	6.98	2,124
Oct. 19	do	203	517.0	2.42	5.45	1,251
Nov. 16	do				4.86	500
Dec. 9	do	106	244.0	1.29	4.81	314
Dec. 29	do	93	200.0	0.85	4.92	170

Daily Gauge Height and Discharge of Battle river at Battleford, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.37*b*	69	3.44	40	3.43	23	4.15	37	5.53	1,323	5.11	1,104
2	3.37	67	3.42	36	3.45	24	4.19	40	5.33	1,219	4.99	1,042
3	3.37	65	3.44	38	3.48	25	4.34	45	5.16	1,130	4.86	977
4	3.36	62	3.46	40	3.49	25	4.49	50	5.07	1,083	4.76	927
5	3.35	60	3.48	41	3.46	22	5.09	55	5.11	1,104	4.75	922
6	3.34	58	3.50	42	3.48	22	5.58	60	5.18	1,141	4.73	912
7	3.33	56	3.49	40	3.45	20	6.14	80	5.31	1,208	4.95	1,022
8	3.34	55	3.47	39	3.39	18	6.69	120	5.19	1,146	4.97	1,032
9	3.35	53	3.46	36	3.41	18	7.28	150	5.01	1,052	4.99	1,042
10	3.35	50	3.47	37	3.42	19	7.31	200	4.92	1,007	5.00	1,047
11	3.34	49	3.49	38	3.44	20	7.62	400	4.83	962	5.06	1,078
12	3.33	47	3.51	40	3.43	21	7.95	500	4.80	947	5.33	1,219
13	3.34	47	3.49	38	3.44	22	11.00*x*	900	4.73	912	5.35	1,229
14	3.34	46	3.47	35	3.46	20	16.50	950	4.66	877	5.31	1,208
15	3.35	45	3.48	37	3.47	20	15.50	1,000	4.72	907	5.53	1,323
16	3.35	44	3.50	38	3.51	20	12.00	1,300	4.69	892	5.66	1,390
17	3.34	41	3.47	34	3.52	20	9.50*x*	1,500	4.65	872	7.31	2,341
18	3.33	38	3.48	33	3.51	18	7.63	1,600	4.65	872	7.51	2,477
19	3.33	36	3.48	33	3.53	15	7.34	1,500	4.63	862	7.12	2,215
20	3.32	35	3.45	33	3.56	15	7.01*b*	1,450	4.60	847	6.94	2,103
21	3.36	38	3.44	30	3.68	21	6.83	2,039	4.53	812	6.72	1,977
22	3.35	38	3.39	26	3.69	24	6.68	1,955	4.51	802	6.58	1,899
23	3.36	38	3.42	26	3.69	24	6.56	1,888	4.50	797	6.37	1,781
24	3.35	38	3.43	25	3.70	23	6.34	1,764	4.50	797	6.15	1,658
25	3.36	37	3.45	25	3.78	25	6.20	1,686	4.49	792	5.97	1,557
26	3.34	33	3.47	25	3.85	25	6.07	1,613	4.48	787	5.75	1,438
27	3.38	38	3.46	26	3.94	25	5.92	1,530	4.48	787	5.56	1,338
28	3.40	39	3.47	26	3.99	27	5.75	1,438	4.46	777	5.44	1,276
29	3.41	40	3.47	26	4.05	30	5.66	1,390	4.54	817	5.47	1,291
30	3.38	36	.....	.....	4.09	33	5.65	1,385	4.60	847	5.48	1,297
31	3.36	34	.....	.....	4.12	35	.....	.....	4.96	1,027	.....	.....

b Ice conditions from January 1 to April 20.
x Water higher than gauge measures. Elevations estimated from known H.W.M. from April 13 to 17.

DAILY GAUGE HEIGHT AND DISCHARGE of Battle river at Battleford, for 1916.—*Concluded.*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	5.48	1,297	5.75	1,438	5.46	1,286	7.15	2,235	5.01	1,052	5.08	.....
2	5.66	1,390	5.75	1,438	5.33	1,219	7.08	2,190	4.99	1,042	5.00	.....
3	5.76	1,443	5.72	1,422	5.19	1,146	7.01	2,146	4.98	1,037	4.92	.....
4	5.90	1,519	5.67	1,395	5.16	1,130	6.95	2,109	4.97	1,032	.....	.....
5	6.05	1,602	6.05	1,602	5.17	1,135	6.82	2,033	4.96	1,027	.....	.....
6	6.97	2,121	6.02	1,585	5.20	1,151	6.66	1,944	4.95	1,022	.....	.....
7	6.49	1,848	6.02	1,585	5.35	1,229	6.55	1,882	4.94	1,017	.....	.....
8	6.05	1,602	6.00	1,574	5.46	1,286	6.43	1,815	4.94	1,017	.....	.....
9	6.20	1,686	5.76	1,443	5.53	1,323	6.30	1,742	4.91	1,002	4.81	314*d*
10	7.05	2,171	5.53	1,323	6.78	2,011	6.18	1,675	4.87	982	.....	.....
11	7.10	2,202	5.72	1,422	7.64	2,568	6.08	1,619	4.83	962	.....	.....
12	6.72	1,977	5.64	1,380	7.55	2,505	5.99	1,568	5.06	1,078	.....	.....
13	6.42	1,809	5.56	1,338	7.43	2,421	5.92	1,530	.....	1,000*e*	.....	.....
14	6.29	1,736	5.52	1,317	7.35	2,367	5.84	1,487	.....	750*e*	.....	.....
15	6.03	1,591	5.40	1,255	7.19	2,261	5.75	1,438	.....	600*e*	.....	.....
16	5.88	1,508	5.28	1,193	7.16	2,242	5.65	1,385	4.86	500*e*	.....	.....
17	5.88	1,508	5.29	1,198	7.14	2,228	5.53	1,323	.....	500*e*	4.81	.....
18	5.92	1,530	5.24	1,172	7.11	2,209	5.40	1,255	4.95	490*e*	.....	.....
19	5.92	1,530	5.19	1,146	7.12	2,115	5.39	1,250	5.14	480*e*	.....	.....
20	5.90	1,519	5.17	1,135	7.10	2,202	5.35	1,229	5.16*b*	480*e*	.....	.....
21	5.95	1,546	5.16	1,130	7.07	2,183	5.32	1,213	5.19	480*e*	.....	.....
22	5.98	1,563	5.21	1,156	7.04	2,165	5.28	1,193	5.21	470*e*	.....	.....
23	6.02	1,585	5.14	1,120	7.01	2,146	5.25	1,177	5.24	450*e*	.....	.....
24	6.02	1,585	5.12	1,109	6.97	2,121	5.21	1,156	5.26	440*e*	.....	.....
25	6.00	1,574	5.05	1,073	7.07	2,183	5.18	1,141	5.28	410*e*	.....	.....
26	6.00	1,574	6.37	1,781	7.18	2,255	5.16	1,130	5.31	400*e*	.....	.....
27	5.99	1,568	6.30	1,742	7.25	2,301	5.13	1,115	5.26	390*e*	.....	.....
28	5.92	1,530	6.09	1,624	7.25	2,301	5.12	1,109	5.24	390*e*	.....	.....
29	5.86	1,497	5.88	1,508	7.25	2,301	5.10	1,099	5.18	380*e*	4.92	170*d*
30	5.82	1,476	5.66	1,390	7.19	2,261	5.07	1,083	5.13	375*e*	4.96	.....
31	5.75	1,438	5.53	1,323	.....	.....	5.04	1,068	.....	.....	4.95*b*	.....

e Discharge estimated.
x Mean daily discharge estimated from discharge measurements.
b Ice conditions November 20 to December 31.
d Actual measurement.

MONTHLY DISCHARGE of Battle river near Battleford, for 1916

(Drainage area 11,850 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	69	33	46	0.004	0.005	2,828
February	42	25	34	0.003	0.003	1,956
March	35	15	23	0.002	0.002	1,414
April	2,039	37	954	0.080	0.090	56,767
May	1,323	777	949	0.080	0.090	58,352
June	2,477	912	1,404	0.119	0.130	83,544
July	2,202	1,297	1,630	0.138	0.160	100,225
August	1,781	1,073	1,365	0.115	0.130	83,931
September	2,568	1,130	1,942	0.164	0.180	115,557
October	2,235	1,068	1,495	0.126	0.150	91,924
November	1,078	375	708	0.060	0.070	42,129
December	.....	.....	240*x*	0.020	0.020	14,757
The year	.....	.....	.....	.....	1.030	653,384

x Estimated from discharge measurements.

NORTH SASKATCHEWAN RIVER AT PRINCE ALBERT

Location.—On River lot 76, Prince Albert settlement, at the Canadian Northern railway and traffic bridge.

Records available.—October 2, 1911, to December 31, 1916.

Gauge.—Chain; zero elevation has been maintained at 1,370.397 feet since establishment.

Bench-mark.—Brass bolt on top of right abutment of bridge, downstream side, marked "P.W.D. B.M. 47." Elevation of bench-mark 1,403.502 feet above mean sea-level, determined by Canadian Geodetic Surveys.

Channel.—Partly boulders, partly sand. Not liable to very great changes.

Discharge measurements.—From bridge at gauge.

Open water.—April 22, to November 19, 1916.

Observer.—W. Moodie.

DISCHARGE MEASUREMENTS of North Saskatchewan river at Prince Albert, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 6, 7, 8	F. R. Shenstone	646	2,525	0.63	4.16	1,596
Feb. 3, 4	do	636	2,314	0.47	4.18	1,094
Mar. 7, 8, 9	do	623	2,157	0.63	4.46	1,349
Mar. 28, 29	do	629	2,182	0.62	4.55	1,351
May 9	do	764	4,155	1.98	5.66	8,227
June 2	do	752	4,337	1.84	5.60	8,000
June 26	do	883	10,873	4.79	13.70	52,164
June 26	do	883	11,139	4.89	13.92	54,557
June 29	do	874	9,413	4.70	11.89	38,994
June 30	do	872	8,695	4.06	11.22	35,291
July 17	J. R. Estey	873	9,291	4.25	11.84	39,546
Aug. 9	do	854	6,922	3.46	9.03	23,922
Aug. 24	F. R. Shenstone	845	6,513	3.09	8.32	20,149
Sept. 28-29	do	826	5,576	2.74	7.23	15,328
Oct. 24-25	do	771	4,396	2.05	5.77	9,012
Nov. 18	do	711	3,424	1.21	4.78	4,156
Dec. 13-14	do	815	3,056	1.00	5.70	3,053

Ice conditions, Jan. 1 to April 21, and Nov. 20 to Dec. 31.
Open water conditions April 22 to Nov. 19.

DAILY GAUGE HEIGHT AND DISCHARGE of North Saskatchewan river at Prince Albert, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.17[b]	1,700	4.17	1,120	4.26	1,200	4.69	1,500	6.87	13,715	5.56	7,820
2	4.15	1,670	4.17	1,100	4.26	1,210	4.75	1,620	6.84	13,580	5.60	8,000
3	4.20	1,650	4.20	1,090	4.30	1,220	4.75	1,700	6.35	11,375	5.68	8,360
4	4.18	1,620	4.18	1,100	4.32	1,250	4.70	1,800	5.85	9,125	6.16	10,520
5	4.15	1,610	4.15	1,100	4.36	1,280	4.72	1,940	5.48	7,460	6.51	12,095
6	4.23	1,590	4.15	1,110	4.40	1,300	4.76	2,120	5.40	7,100	6.88	13,760
7	4.15	1,580	4.15	1,090	4.45	1,330	4.80	2,260	5.39	7,060	7.38	16,010
8	4.10	1,500	4.18	1,060	4.45	1,350	4.85	2,480	5.49	7,505	8.42	20,816
9	4.15	1,500	4.17	1,060	4.45	1,360	4.95	2,800	5.66	8,270	9.06	23,900
10	4.20	1,552	4.17	1,070	4.46	1,380	5.01	3,050	5.73	8,585	8.78	22,544
11	4.23	1,620	4.15	1,070	4.48	1,390	5.11	3,320	6.26	10,970	8.57	21,536
12	4.25	1,660	4.14	1,060	4.35	1,300	5.24	3,680	7.18	15,110	8.92	23,216
13	4.20	1,650	4.14	1,050	4.30	1,160	5.45	4,000	7.36	15,920	9.12	24,200
14	4.18	1,600	4.14	1,040	4.30	1,160	6.17	4,500	7.20	15,200	8.90	23,120
15	4.16	1,560	4.12	1,010	4.35	1,180	7.35	5,200	6.94	14,030	8.59	21,632
16	4.13	1,500	4.10	1,040	4.39	1,220	7.64	5,800	6.69	12,905	8.39	20,672
17	4.11	1,450	4.12	1,070	4.46	1,300	8.15	6,200	6.41	11,645	8.22	19,856
18	4.07	1,400	4.14	1,100	4.52	1,370	9.21	7,100	6.14	10,430	8.29	20,192
19	4.05	1,380	4.16	1,120	4.49	1,300	10.72	8,000	5.87	9,215	8.43	20,864
20	4.02	1,350	4.16	1,150	4.43	1,240	10.96	8,500	5.65	8,225	8.51	21,248
21	4.00	1,200	4.17	1,180	4.46	1,250	8.65[b]	10,000	5.46	7,370	8.35	20,480
22	3.95	1,080	4.19	1,200	4.46	1,260	7.78	17,810	5.34	6,860	8.28	20,144
23	3.95	1,100	4.21	1,220	4.49	1,280	6.87	13,715	5.28	6,620	8.46	21,008
24	3.97	1,130	4.24	1,230	4.49	1,290	6.86	13,670	5.20	6,300	11.23	35,422
25	3.99	1,170	4.24	1,220	4.50	1,300	6.90	13,850	5.18	6,220	12.25	41,710
26	4.06	1,200	4.24	1,200	4.52	1,320	7.17	15,065	5.22	6,380	13.79	53,120
27	4.12	1,240	4.24	1,200	4.55	1,340	7.93	18,485	5.25	6,500	13.80	53,200
28	4.16	1,270	4.23	1,200	4.55	1,340	7.44	16,280	5.24	6,460	12.68	44,660
29	4.17	1,210	4.26	1,200	4.55	1,360	6.88	13,760	5.21	6,340	11.80	38,800
30	4.16	1,190	.....	.....	4.65	1,400	6.61	12,545	5.27	6,580	11.12	34,790
31	4.18	1,160	.....	.....	4.68	1,440	.....	.....	5.44	7,280	.....	.....

[b] Ice conditions, January 1 to April 21; discharge from winter graph.

DAILY GAUGE HEIGHT AND DISCHARGE of North Saskatchewan river at Prince Albert, for 1916—*Concluded*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	10.66	32,230	8.52	21,296	9.20	24,600	7.02	14,390	6.54	12,230	6.84	4,150
2	10.40	30,800	8.40	20,720	9.22	24,700	7.02	14,390	6.48	11,960	7.00	4,130
3	10.43	30,965	10.00	28,600	8.98	23,504	6.98	14,210	6.34	11,330	7.03	4,110
4	11.00	34,100	11.43	36,580	8.81	22,688	6.91	13,895	6.24	10,880	6.98	4,070
5	11.42	36,520	10.86	33,330	8.64	21,872	7.00	14,300	6.20	10,700	6.78	3,990
6	11.20	35,250	10.23	29,865	8.50	21,200	6.90	13,850	6.14	10,430	.....	3,890
7	10.81	33,055	9.69	27,050	8.40	20,720	6.72	13,040	6.04	9,980	.....	3,790
8	10.44	31,020	9.20	24,600	8.49	21,152	6.62	12,590	5.93	9,485	.....	3,700
9	10.37	30,635	9.04	23,800	8.69	22,112	6.48	11,960	5.67	8,315	.....	3,600
10	11.91	39,466	9.14	24,300	9.05	23,850	6.43	11,735	5.44	7,280	.....	3,490
11	13.02	47,150	9.57	26,450	10.61	31,955	6.40	11,600	5.07	5.780	.....	3,380
12	12.16	41,116	9.98	28,500	11.66	37,960	6.34	11,330	4.28	2,890	.....	3,260
13	11.43	36,580	9.59	26,550	11.31	35,882	6.24	10,880	3.90	2,000	5.65	3,150
14	10.94	33,770	9.24	24,800	10.77	32,835	6.13	10,385	3.95	2,100	5.75	3,050
15	10.83	33,165	8.94	23,312	10.26	30,030	6.09	10,205	4.81	4,740	5.77	3,000
16	11.76	38,560	8.76	22,448	9.94	28,300	6.07	10,115	4.68	4,230	5.70	2,950
17	11.86	39,160	8.80	22,640	9.84	27,800	6.08	10,160	4.50	3,600	5.58	2,900
18	11.46	36,760	.....	22,928*e*	9.50	26,100	6.02	9,890	4.80	4,700	5.55	2,880
19	11.04	34,330	8.92	23,216	9.02	23,700	5.99	9,755	5.08	5,820	5.60	2,850
20	11.20	35,250	8.69	22,112	8.54	21,392	5.95	9,575	5.26*b*	4,090	5.55	2,800
21	11.35	36,112	8.32	20,336	8.34	20,432	5.85	9,125	5.38	4,100	5.48	2,760
22	10.76	32,780	8.15	19,520	8.13	19,424	5.84	9,080	5.35	4,100	5.45	2,720
23	10.14	29,370	8.15	19,520	7.84	18,080	5.83	9,035	5.38	4,110	5.41	2,690
24	9.86	27,900	8.32	20,336	7.66	17,270	5.77	8,765	5.66	4,120	5.35	2,670
25	10.34	30,470	8.78	22,544	7.47	16,415	5.78	8,810	6.04	4,140	.....	2,620
26	10.58	31,790	9.81	27,650	7.33	15,785	5.96	9,620	6.36	4,160	.....	2,600
27	10.04	28,820	10.52	31,460	7.26	15,470	6.46	11,870	6.31	4,180	.....	2,550
28	9.50	26,100	10.04	28,820	7.21	15,245	6.93	13,985	6.56	4,190	.....	2,500
29	9.12	24,200	9.50	26,100	7.20	15,200	6.86	13,670	6.57	4,190	.....	2,470
30	8.73	22,304	9.12	24,200	7.12	14,840	6.72	13,040	6.67	4,180	.....	2,450
31	8.40	20,720	9.12	24,200	.....	.....	6.60	12,500	.....	.....	.....*b*	2,420

e Discharge estimated.
b Ice conditions from November 20 to December 31; discharge from winter graph.

MONTHLY DISCHARGE of North Saskatchewan river at Prince Albert, for 1916

(Drainage area 59,900*x* square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	1,700	1,080	1,422	0.024	0.03	87,414
February	1,230	1,010	1,160	0.019	0.02	66,708
March	1,440	1,160	1,293	0.022	0.02	79,485
April	18,485	1,500	7,425	0.124	0.14	441,713
May	15,920	6,220	9,366	0.156	0.18	575,756
June	53,200	7,820	24,123	0.403	0.45	1,435,077
July	47,150	20,720	32,918	0.549	0.63	2,023,568
August	36,580	19,520	25,090	0.419	0.48	1,543,024
September	37,960	14,840	23,017	0.384	0.43	1,369,281
October	14,390	8,765	11,540	0.193	0.22	709,398
November	12,230	2,000	6,134	0.102	0.11	364,912
December	4,150	2,420	3,148	0.052	0.06	193,517
The year	.....	.....	.....	.....	2.77	8,889,853

x The drainage area in this table is only approximate.
It must be remembered that the greater part of the run-off at this station is derived from the eastern slope of the Rocky mountains, and must not be used to base estimates of run-off on other streams in this vicinity.

Monthly Discharge of North Saskatchewan river at Prince Albert, for 1915

(Drainage area 59,900*a* square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	2,150	1,280	1,760	0.0294	0.03	108,219
February	1,800	1,550	1,655	0.0276	0.03	91,914
March	2,050	1,570	1,707	0.0285	0.03	104,960
April	18,500	2,250	9,046	0.1510	0.17	538,274
May	10,700	4,820	7,003	0.1169	0.13	430,597
June	42,660	9,940	25,023	0.4177	0.47	1,488,972
July	186,546	33,200	60,224	1.0054	1.16	3,703,029
August	36,430	21,850	28,129	0.4696	0.54	1,729,585
September	24,460	9,150	14,999	0.2504	0.28	892,503
October	9,190	6,030	7,653	0.1278	0.15	470,564
November	6,010	2,620	3,896	0.0650	0.07	231,828
December	2,880	1,700	2,238	0.0374	0.04	137,609
The year					3.10	9,928,054

a The drainage area in this table is only approximate.

It must be remembered that the greater part of the run-off at this station is derived from the eastern slope of the Rocky mountains, and must not be used to base estimates of run-off on other streams in this vicinity.

MEAN MONTHLY DISCHARGE in Second-feet of North Saskatchewan river at Prince Albert

MONTH	1909-10	1910-11	1911-12	1912-13	1913-14	1914-15	1915-16	1916-17	Mean in Sec.-ft.	Mean in Acre-ft.
October		*b* 8,120	*d* 7,902	10,024	7,114	7,763	7,653	11,540	8,666	542,200
November				4,915	3,022	3,736	3,896	6,134	4,341	258,267
December				2,315	1,819	2,533	2,238	3,148	2,411	148,212
January			1,505	1,663	1,221	1,760	1,422		1,514	93,101
February			1,584	1,583	1,191	1,655	1,160		1,435	80,759
March			1,579	1,981	1,295	1,707	1,293		1,571	96,554
April			9,022	16,330	4,350	9,046	7,425		9,237	549,475
May		*c* 9,817	11,280	12,149	13,235	7,003	9,366		10,607	652,143
June	*a* 16,600	14,828	14,864	19,042	30,347	25,023	24,123		21,371	1,104,950
July	15,346	25,956	35,301	26,186	29,456	60,224	32,918		32,198	1,979,715
August	13,904	25,682	30,044	25,096	14,550	28,129	25,090		23,214	1,427,390
September	12,609	16,438	22,277	14,576	10,304	14,999	23,017		16,317	970,895
Total in Acre-feet	2,845,134	5,905,568	8,193,612	8,235,406	7,147,276	8,943,435	8,462,027			7,903,661

a 22-30,
b 1, 8, 31.
c 8-31.
d 1-29.

SPRUCE (LITTLE RED) RIVER NEAR PRINCE ALBERT

Location.—On the SW. ¼ Sec. 26, Tp. 49, Rge. 26, W. 2nd Mer.

Records available.—July 14, 1916, to October 31, 1916; discharge measurements only in 1916.

Gauge.—Vertical staff; zero elevation has been maintained at an elevation of 89.62 feet since establishment.

Bench-mark.—Spike in top of eight-inch poplar stump on right bank; 100 feet up stream from gauge; assumed elevation 100.00 feet.

Channel.—Shifting silt; gauge height affected by logs lying in or being driven down river.

Discharge measurements.—Made with current-meter at or near gauge by wading, or from bridge one mile down stream.

Fluctuations in flow.—Caused by artificial regulation of lake outlets.

Winter flow.—Discharge measurements have been made, but no gauge height observations taken.

Remarks.—Unable to obtain a gauge observer on this stream. Log drives prevented gaugings during open water season.

DISCHARGE MEASUREMENTS of Spruce river near Prince Albert, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft*
Jan. 8	F. R. Shenstone	7.5	1.83	0.42	0.62	0.78
Feb. 5	do	5.7	2.04	0.48	2.00	0.98
Mar. 9	do					0.50*e*
Mar. 29	do	3.2	0.21	Nil		Nil
May 9	do				3.10	150.00*e*
June 3	do				3.71	400.00*e*
July 18	J. R. Estey					250.00*e*
Aug. 25	F. R. Shenstone					100.00*e*
Sept. 29	do	27.0	20.40	1.36		28.00
Oct. 25	do	27.5	31.60	1.42		45.00
Nov. 20	do	29.0	41.50	1.64		69.00
Dec. 14	do	29.0	1.44	0.86		1.24

e Discharge estimated from field inspection; logs running May 9, June 3, July 18, Aug. 25, prevented gauging.

MISCELLANEOUS DISCHARGE MEASUREMENTS made in North Saskatchewan river drainage basin, in 1916

Date	Engineer	Stream	Location	Width	Area of Section	Mean Velocity	Discharge
				Feet	*Sq. feet*	*Ft. per sec.*	*Sec.-ft.*
Oct. 26	C. M. O'Neil	Bighorn river	250 ft. above falls Sec. 33-39-17-5	32.5	26.7	3.14	84.00
Oct. 12	do	Clearwater river	4 mi. above Idlewilde F.S. Sec. 29-35-11-5	88.0	135.4	2.75	372.00
Oct. 13	do	do	At mouth of Dry channel Sec. 19-34-12-5	83.5	127.0	2.57	326.00
Oct. 14	do	do	Near Indian Head camp Sec. 13-33-15-5	52.0	57.2	2.85	163.00
Aug. 13	do	Carol creek	At Head of canyon Sec. 12-37-19-5	46.5	42.1	0.90	108.00
Aug. 11	do	Pinto creek (Moin)	At outlet from Pinto lake Sec. 33-36-21-5	47.5	31.5	1.25	40.00
Oct. 3	do	Ram river (N. Fork)	500 ft. below forks Sec. 2-38-12-5	76.8	160.6	2.41	400.00
Oct. 4	do	do (S. Fork)	Near Rough F.S. Sec. 25-38-15-5	62.0	62.0	1.09	67.00
Sept. 19	do	do	About 12 miles above mouth Sec. 9-35-15-5	34.0	34.3	1.76	60.00
Sept. 21	do	do	1½ miles above High falls Sec. 19-36-13-5	52.0	73.5	4.23	313.00
Nov. 2	do	Saunders creek	50 ft. below C.N.R. trestle Sec. 24-40-13-5	4.5	1.4	0.67	0.90
Sept. 18	do	Whiterabbit creek	6 mi. below Whiterabbit F.S. Sec. 9-35-16-5	16.0	16.5	2.05	40.00

NOTE.—Locations by sections; approximations only.

RED DEER RIVER DRAINAGE BASIN

General Description

The Red Deer river rises in the Sawback range of the Rocky mountains in the northern portion of the Rocky Mountain park, near the boundary between the provinces of Alberta and British Columbia. It flows eastward for about forty miles, then northeastward for seventy or eighty miles to a point near Red Deer, Alberta. From here the river flows in a southeasterly and easterly direction to its confluence with the South Saskatchewan river, just east of the 4th Mer., in Tp. 22, Rge. 28, W. 3rd Mer. It has a length of approximately 400 miles.

The valley of the Red Deer is wide and deep, the banks being rough and cut up with a large number of deep coulees draining into the river. Near the source the basin is well timbered, and a good growth of timber is found along its banks for some distance out into the prairie. Seams of coal, well suited for domestic use, are found in the valley and form the principal source of fuel supply for the settlers along the stream in the prairie section.

The river carries a considerable supply of water at all times of the year, but the volume is subject to sudden variations, due to the melting of snow in the mountains and heavy summer rains.

Of the tributaries of the Red Deer, the most important are the Panther river near its head, Little Red Deer and Medicine rivers entering in Tp. 36, Rge. 1, W. 5th Mer., and Rosebud river emptying into it in Tp. 28, Rge. 19, W. 4th Mer. In addition, there are numerous small streams draining into the main river in the western portion of the basin. From the mouth of the Rosebud river eastward, there is very little drainage into the river.

Very little water is taken from the Red Deer and its branches for irrigation purposes. There are only a few small schemes on some of the smaller tributaries. The land along the valley, though lacking moisture, is extremely fertile and with the help of irrigation much of it might be cultivated and fine crops produced. The irrigation of the bench land from the river would be difficult on account of the small fall in the river, the depth of the valley and the rolling nature of the lands in the drainage basin.

Very little hydrometric work has been done in this basin as yet. A gauging station was established on the Red Deer river near Innisfail in 1910, but an observer could not be secured and only periodic measurements were secured at this station. In December, 1911, another gauging station was established at the town of Red Deer, and continuous records have been obtained since then. In October, 1915, a station was established in the town of Drumheller, and has been maintained up to the present.

Of the tributaries of the Red Deer river, Berry and Blood Indian creeks are the only ones that have, until recently, been given any attention. These small creeks, which drain into the river in the prairie section, have a few small irrigation rights registered against them. Gauging stations were established on them in 1911, but owing to the high cost of obtaining data they were abandoned in 1913. Records were, however, started on Blindman river in 1914.

A special report upon the floods in this drainage basin was published in an Appendix to the 1915 report.

RED DEER RIVER AT RED DEER

Location.—On the SE. ¼ Sec. 20, Tp. 38, Rge. 27, W. 4th Mer., at the steel traffic bridge in the town of Red Deer.

Records available.—January 1, 1912, to December 31, 1916.

Gauge.—Chain: Length of chain from bottom of weight to marker is 29.52 feet; zero elevation of gauge maintained at 48.40 feet since establishment.

Bench-mark.—Marked with white paint on northwest face of north abutment; assumed elevation 100.00 feet.

Channel.—Slightly shifting.

Discharge measurements.—Made from bridge.

Winter flow.—From November to April, river is frozen over and measurements are made at a point about one-half mile below the bridge.

Observer.—C. H. Snell.

DISCHARGE MEASUREMENTS of Red Deer river at Red Deer, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 19	O. H. Hoover	281	295	1.60	5.95	471
Feb. 16	S. H. Frame	209	168	1.90	5.91	319
Mar. 10	O. H. Hoover	220	324	1.72	6.26	558
April 5	do	250	829	2.03	8.03	1,684
April 20	do	278	939	2.27	4.81	2,132
April 22	do	277	915	1.99	4.70	1,823
May 15	C. M. O'Neil	278	909	1.78	4.68	1,621
June 10	H. S. Kerby	382	2,144	3.93	7.68	8,427
June 20	J. R. Estey	418	2,903	5.90	9.38	17,104
June 24	A. W. Lowrie	383	1,991	4.20	7.35	8,365
June 30	H. S. Kerby	411	2,569	4.68	8.58	12,059
July 26	do	383	1,924	3.77	7.07	7,268
Aug. 19	do	423	3,390	6.96	11.09	23,592
Aug. 20	do	423	3,527	7.09	11.36	24,992
Sept. 2	do	374	1,614	3.53	6.71	5,698
Sept. 29	W. K. Broughton	352	1,211	2.85	5.68	3,452
Oct. 20	do	353	1,291	2.93	5.86	3,779
Nov. 10	do	280	.....	.....	4.87	2,200*e*
Dec. 1	W. T. Reeve	423	853	1.27	6.41	1,088
Dec. 22	do	407	575	1.36	6.22	792

e Discharge estimated, from gauge height and velocity.

Daily Gauge Height and Discharge of Red Deer river at Red Deer, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft*
1	5.84*b*	460	5.83	362	6.19	382	7.73	1,650	4.77	2,003	9.95	17,980
2	5.79	450	5.83	372	6.28	390	7.78	1,660	5.68	3,460	9.35	15,275
3	5.78	440	5.86	378	6.27	400	8.43	1,650	6.16	4,452	8.78	12,858
4	5.73	445	5.88	380	6.29	412	8.73	1,650	6.15	4,430	8.82	13,024
5	5.74	460	5.87	380	6.24	420	8.00	1,684	6.06	4,232	9.02	13,865
6	5.86	478	5.87	376	6.22	435	7.71*a*	1,750	5.80	3,700	8.70	12,530
7	5.96	466	5.87	370	6.22	458	7.42	1,810	5.58	3,264	8.19	10,563
8	6.03	450	5.87	360	6.23	490	7.49	1,810	5.43	2,994	7.88	9,428
9	6.08	435	5.88	350	6.25	520	7.85	1,814	5.17	2,555	7.73	8,902
10	6.10	420	5.88	346	6.27	558	7.68	1,846	5.02	2,330	7.76	9,004
11	6.05	420	5.89	335	6.45	590	7.34	2,230	4.87	2,131	7.67	8,698
12	6.02	425	5.92	326	6.64	635	7.12	2,400	4.76	1,990	7.46	8,012
13	5.95	432	5.92	318	8.28	710	6.73	2,940	4.70	1,915	7.32	7,572
14	5.93	440	5.91	314	9.09	772	5.58*b*	3,210	4.68	1,890	7.36	7,696
15	5.94	442	5.89	310	8.24	772	5.67	3,440	4.68	1,890	7.70	8,800
16	5.93	452	5.95	319	7.54*a*	756	5.79	3,680	4.67	1,878	8.40	11,360
17	5.92	460	6.01	340	7.24	752	5.36	2,872	4.66	1,865	8.80	12,940
18	5.92	463	6.42	368	7.31	756	5.13	2,495	4.68	1,890	8.78	12,858
19	5.94	471	7.25	394	7.07	760	4.96	2,248	4.70	1,965	8.89	13,318
20	5.93	470	6.88	414	7.23	790	4.85	2,105	4.78	2,015	9.39	15,447
21	5.92	450	6.84	428	7.51	870	4.75	1,978	4.80	2,040	9.62	16,450
22	5.92	400	7.02	433	8.21	984	4.69	1,902	4.77	2,003	9.80	17,260
23	5.90	370	6.98	440	10.60	1,160	4.58	1,766	4.74	1,965	7.92	9,572
24	5.86	360	7.22	440	11.23	1,290	4.48	1,646	4.85	2,105	7.54	8,268
25	5.69	350	6.72	438	10.25	1,294	4.42	1,574	5.33	2,821	7.36	7,696
26	5.76	340	6.68*a*	424	9.56	1,294	4.41	1,562	5.80	3,700	7.35	7,665
27	5.77	320	6.50*a*	404	8.94	1,304	4.58	1,766	6.08	4,276	7.89	9,464
28	5.77	322	6.40*a*	390	8.82	1,332	4.89	2,157	6.53	5,325	9.36	15,318
29	5.81	324	6.30	380	8.35	1,390	4.95	2,235	7.25	7,355	9.03	13,908
30	5.82	336	.....	.....	8.01	1,465	4.79	2,028	8.33	11,094	8.54	11,892
31	5.82	348	.....	.....	7.93	1,550	.....	.....	9.42	15,577	.....	.....

a Gauge height interpolated.
b–b Ice conditions.

DAILY GAUGE HEIGHT AND DISCHARGE of Red Deer river at Red Deer, for 1916—*Concluded*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	7.94	9,644	6.52	5,300	6.44	5,100	5.67	3,440	5.32	2,804	6.52*a*	1,090
2	7.75	8,970	6.24	4,632	6.69	5,725	5.73	3,560	5.28	2,736	6.63	1,070
3	8.28	10,904	6.34	4,862	6.63	5,575	5.69	3,480	5.21	2,617	6.50	1,050
4	9.34	15,232	6.71	5,775	8.17	10,489	5.64	3,380	5.24	2,668	6.53	1,030
5	9.75	17,035	7.01	6,630	10.76	21,944	5.56	3,228	5.20	2,600	6.40	996
6	9.01	13,822	7.01	6,630	10.47	20,523	5.54	3,192	5.16	2,540	6.26	950
7	8.46	11,588	6.83	6,090	9.45	15,708	5.59	3,282	4.90	2,170	5.92	900
8	8.33	11,094	6.64	5,600	8.69	12,489	5.57	3,246	4.86	2,118	5.87	870
9	8.41	11,398	6.40	5,000	8.32	11,056	5.47	3,066	4.91	2,183	5.75	850
10	8.37	11,246	6.22	4,586	7.95	9,680	5.41	2,958	4.89	2,157	5.83	850
11	7.93	9,608	6.41	5,025	7.71	8,834	5.39	2,923	4.57*b*	1,754	6.03	850
12	7.53	8,236	6.51	5,275	7.43	7,916	5.34	2,838	6.08	1,750	5.82	870
13	7.25	7,355	5.92	3,940	7.15	7,050	5.32	2,804	6.08	1,765	6.05	880
14	7.27	7,417	5.78	3,660	7.12	6,960	5.25	2,685	6.08	1,778	6.33	885
15	6.89	6,270	5.64	3,380	6.92	6,360	5.27	2,719	6.08	1,774	6.33	880
16	6.57	5,425	5.53	3,174	6.69	5,725	5.27	2,719	6.09	1,750	6.51	870
17	6.58	5,450	5.58	3,264	6.50	5,250	5.45	3,030	6.09	1,720	6.60	850
18	6.91	6,330	5.82	3,740	6.38	4,954	5.79	3,680	6.09	1,680	6.46	830
19	7.29	7,479	10.18	19,102	6.19	4,518	5.91	3,920	6.38*a*	1,630	6.44	820
20	7.19	7,170	11.34	24,874	6.08	4,276	5.88	3,860	6.67*a*	1,590	6.41	810
21	6.71	5,775	10.34	19,886	5.97	4,040	5.91	3,920	6.96*a*	1,540	6.41	800
22	6.45	5,125	9.14	14,375	5.87	3,840	5.97	4,040	7.25	1,490	6.22	790
23	6.21	4,563	8.56	11,968	5.80	3,700	6.02	4,144	6.92	1,440	6.10	760
24	6.03	4,166	8.28	10,904	5.75	3,600	6.00	4,100	6.87	1,400	6.04	710
25	6.39	4,977	7.81	9,176	5.73	3,560	6.04	4,188	6.74	1,340	6.04	680
26	7.08	6,840	7.34	7,634	5.76	3,620	5.98	4,060	6.80	1,280	5.97	670
27	7.55	8,360	7.03	6,690	5.78	3,660	5.94	3,980	6.70	1,240	5.90	670
28	7.48	8,076	6.84	6,120	5.73	3,560	5.83	3,760	6.75	1,190	5.92	670
29	7.36	7,696	6.54	5,350	5.68	3,460	5.66	3,420	6.34	1,150	5.85	710
30	7.04	6,720	6.39	4,977	5.64	3,380	5.46	3,048	6.41	1,120	5.75	730
31	6.75	5,875	6.37	4,931			5.47	3,066			5.80*b*	740

b-b Ice conditions.

MONTHLY DISCHARGE of Red Deer river at Red Deer, for 1916

(Drainage area 4,396 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	478	320	416	0.095	0.11	25,579
February	440	310	375	0.085	0.09	21,570
March	1,550	382	829	0.190	0.22	50,973
April	3,680	1,562	2,119	0.482	0.54	126,089
May	15,577	1,865	2,939	0.668	0.77	180,712
June	17,980	7,572	11,587	2.636	2.94	689,474
July	17,035	4,166	8,380	1.906	2.20	515,270
August	24,874	3,174	7,502	1.706	2.00	461,280
September	21,944	3,380	7,218	1.642	1.83	429,501
October	4,188	2,685	3,411	0.776	0.89	209,734
November	2,804	1,120	1,832	0.417	0.47	109,012
December	1,090	670	843	0.192	0.22	50,162
The year					12.28	2,869,356

MEAN MONTHLY DISCHARGE in Second-feet of Red Deer river at Red Deer

MONTH	1911-12	1912-13	1913-14	1914-15	1915-16	1916-17	Mean in Sec.-feet	Mean in Acre-feet
October		2,721	1,223	1,439	2,934	3,411	2,346	144,226
November		1,290	825	783	1,195	1,832	1,185	70,512
December		545	327	328	520	843	513	31,184
January	238	417	278	278	416		325	20,008
February	274	396	298	271	375		323	18,186
March	401*a*	410	380	606	829		556	34,202
April	1,919	3,887	902	1,251	2,119		2,016	119,937
May	3,954	4,101	1,908	4,457	2,939		3,472	213,473
June	3,953	4,946	3,669	12,308	11,587		7,293	433,940
July	10,091	5,242	2,351	16,748	8,380		8,562	526,478
August	4,985	3,284	1,309	8,118	7,502		5,040	309,873
September	4,532	1,787	1,098	3,954	7,218		3,718	221,224
Total in acre-feet	1,841,836	1,758,762	881,101	3,069,743	2,783,934			2,143,243

a 1–28.

BLINDMAN RIVER NEAR BLACKFALDS

Location.—On the NE. ¼ Sec. 17, Tp. 39, Rge. 27, W. 4th Mer., two and one-half miles southwest of Blackfalds, Alberta, and eight miles north of Red Deer.

Records available.—Discharge measurements from August 10, 1912, to December 31, 1916. Gauge heights from April 21, 1916, to December 31, 1916.

Gauge.—Vertical staff; elevation of zero maintained at 81.89 feet.

Bench-mark.—Nail in spruce post set four feet into the ground, fifty feet down stream from the staff gauge; assumed elevation 100.00 feet; auxiliary bench-mark on southwest wing wall of bridge; assumed elevation 100.00 feet.

Channel.—One, fairly permanent channel; bed composed of mud and large boulders.

Discharge measurements.—Made by wading at the gauge during low water; during high water measurements made at the traffic bridge two miles down stream.

Winter measurements.—Stream affected by ice from November to April.

Observer.—W. Kinman.

Remarks.—The services of an observer were not obtainable until April 21, 1916.

Accuracy.—Gauge heights were read daily at this station to one-hundredth of a foot at a time of mean daily gauge height.

There were two curves during the open water season, one before and one after the period of high water early in July.

Either one or other of these curves run through all plotted discharge measurement points and results are well within the limit of error.

The winter discharges are obtained from graphs based upon gauge heights, temperatures and occasional discharge measurements and are fair estimates.

DISCHARGE MEASUREMENTS of Blindman river near Blackfalds, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 25	O. H. Hoover	50	64	0 09	8.65	5.9
April 4	do	85	256	1.41	10.05	362.0
April 21	do	69	161	1 10	6 84	177.0
May 14	C. M. O'Neil	79	154	1 36	6.98	208.0
June 15	H. S. Kerby	90	276	2 02	8 37	559.0
June 22	J. R. Estey	84	160	1 66	7 34	261.0
July 6	H. S. Kerby	113	665	3 30	12 39	2,189.0
July 20	do	89	260	1 87	7.93	488.0
Aug. 11	do	85	194	1 50	7.20	292.0
Sept. 7	do	109	560	2.87	11.33	1,609.0
Sept. 28	W. K. Broughton	85	197	1 44	7.16	282.0
Oct. 19	do	86	218	1 52	7.42	333.0
Nov. 11	do	82	158	0 58	6.51	92.0
Dec. 1	W. T. Reeve	80	180	0.40	6.55	71.0
Dec. 23	do	82	220	0 30	6.80	67.0

DAILY GAUGE HEIGHT AND DISCHARGE of Blindman river near Blackfalds, for 1916

DAY	April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			7.12	224	8.11	473
2			7.26	2 9	8.13	480
3			7.51	304	7.82	384
4			7.43	286	7.78	373
5			7.26	249	8.04	451
6			7.14	228	8.14	483
7			7.06	215	7.85	392
8			6.96	199	7.63	334
9			6 86	185	7.53	310
10			6.80	177	8.15	486
11			6.77	173	8.86	716
12			6.81	178	9.58	963
13			6.88	188	9.16	816
14			6.98	202	8.79	693
15			7.04	211	8.37	556
16			7.01	207	7.87	398
17			6.94	197	7.69	350
18			6.86	185	7.54	312
19			6.79	176	7.44	288
20			6.69	164	7.43	286
21	6.84	183	6.67	162	7.42	284
22	6.82	180	6.63	157	7.34	266
23	6.71	166	6 67	162	7.14	228
24	6.64	158	6.89	190	7.00	205
25	6.56	150	7.29	255	6.90	191
26	6.52	146	7.40	279	6.85	184
27	6.51	145	7.65	340	6.97	201
28	6.58	152	7.54	312	7.21	240
29	6.68	163	7.47	295	7.22	242
30	6.84	183	7.49	300	7.14	228
31			7.81	381		

DAILY GAUGE HEIGHT AND DISCHARGE of Blindman river near Blackfalds, for 1916.—*Concluded.*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	7.10	221	7.69	404	7.09	271	7.10	273	6.90	241	6.53	71
2	7.30	257	7.74	419	7.37	324	7.06	266	6.89	240	6.58	69
3	7.77	370	8.10	526	7.45	341	7.04	263	7.02	259	6.53	66
4	10.89	1,442	8.43	628	10.31	1,248	7.04	263	6.91	242	6.54	64
5	12.71	2,141	9.78	1,065	12.24	1,958	7.02	259	6.94	247	6.57	62
6	12.39	2,016	8.98	804	11.62	1,720	6.97	252	6.78	224	6.59	61
7	12.02*a*	1,872	8.39	616	11.29	1,594	6.95	248	6.62	203	6.53	59
8	11.66	1,735	8.08	520	10.31	1,248	6.95	248	6.94	196	6.52	57
9	10.76	1,406	7.68	401	10.16	1,196	6.93	246	6.86	191	6.48	56
10	10.01	1,144	7.38	326	10.17	1,200	6.92	244	6.55	186	6.45	56
11	9.42	947	7.18	288	9.35	924	6.88	238	6.44	180	6.51	58
12	8.94	791	7.03	261	8.85	762	6.84	233	6.56	175	6.55	59
13	8.33	597	6.91	242	8.71	717	6.83	231	6.83	170	6.59	60
14	8.00	495	6.79	226	8.34	600	6.83	231	6.59	167	6.64	61
15	8.81	749	6.71	214	8.01	498	6.80	227	6.67	162	6.68	61
16	8.60	682	6.70	213	7.76	424	6.86	235	6.70	157	6.74	62
17	8.38	613	6.71	214	7.57	370	7.17	286	6.68	154	6.74	63
18	8.22	563	7.60	378	7.42	334	7.36	322	6.70	150	6.74	64
19	8.14	538	9.77	1,062	7.31	313	7.40	330	6.59	145	6.75	65
20	7.93	474	10.12	1,182	7.25	302	7.46	343	6.54	141	6.77	65
21	7.55	365	9.78	1,065	7.04	263	7.58	373	6.64	136	6.78	65
22	7.35	321	8.97	800	7.01	258	7.80	436	6.59	130	6.79	66
23	7.22	296	8.35	604	6.97	252	7.88	459	6.54	125	6.80	67
24	7.09	271	7.74	419	6.94	247	7.84	448	6.64	119	6.81	68
25	7.35	321	7.56	368	7.03	261	7.72	413	6.63	114	6.84	69
26	7.38	326	7.45	341	7.20	292	7.60	378	6.54	107	6.84	70
27	7.45	341	7.23	298	7.20	292	7.48	348	6.53	101	6.85	72
28	8.54	663	7.07	268	7.14	281	7.34	319	6.55	94	6.85	73
29	9.48	966	6.96	250	7.12	277	7.22	296	6.56	87	6.86	74
30	8.78	740	6.92	244	7.11	275	7.09	271	6.55	78	6.83	75
31	8.23	566	6.98	253	.....	.....	6.94	247	.....	.....	6.81	75

a Gauge height interpolated.

MONTHLY DISCHARGE of Blindman river near Blackfalds, for 1916

(Drainage area 712 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
April (21-30)	183	145	163	0.229	0.09	3,929
May	381	157	227	0.319	0.37	13,958
June	963	184	394	0.553	0.62	23,445
July	2,141	271	781	1.097	1.26	48,022
August	1,182	213	481	0.675	0.78	29,576
September	1,958	247	635	0.892	1.00	37,785
October	459	227	298	0.418	0.48	18,323
November	259	78	164	0.230	0.26	9,759
December	75	56	65	0.091	0.10	3,997
The period	.....	.....	.....	.....	4.96	188,794

RED DEER RIVER AT DRUMHELLER

Location.—On the NW. ¼ Sec. 11, Tp. 29, Rge. 20, W. 4th Mer.
Records available.—October 25, 1915, to December 31, 1916.
Gauge.—Vertical staff; elevation of zero maintained at 2,220.22 feet.
Bench-mark.—Canadian topographic survey bench-mark copper plug on right abutment, downstream side; elevation 2,246.89 feet.
Channel.—Permanent.
Discharge measurements.—Made from bridge.
Observer.—S. W. Cameron.

DISCHARGE MEASUREMENTS of Red Deer river at Drumheller, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 8	O. H. Hoover	190	440	0.79	4.60	348
Feb. 22	S. H. Frame	.....	.....	.....	7.05	450*x*
Mar. 14	E. J. Switzer	.....	.....	.....	6.21	670*x*
April 4	H. C. Ritchie	400	1,593	2.25	7.08	3,579
April 25	do	322	1,161	1.88	3.99	2,188
May 16	do	342	1,238	1.88	4.04	2,322
June 6-7	do	438	3,506	4.89	9.68	17,111
June 24	J. R. Estey	425	2,497	4.36	7.77	10,950
July 1	R. J. McGuinness	426	3,203	4.46	8.97	14,304
July 12	H. C. Ritchie	411	2,905	4.56	8.57	13,238
Aug. 4	do	376	1,936	3.30	6.26	6,387
Aug. 20	A. B. Cook	438	4,609	6.39	12.85	29,443
Aug. 21	do	438	4,842	6.15	13.22	29,800*s*
Aug. 21	do	438	4,838	6.15	13.21	29,758
Aug. 21	do	438	4,744	6.11	13.00	28,993
Aug. 22	do	438	4,270	6.02	11.88	25,693
Aug. 22	do	438	4,213	5.90	11.75	24,854*s*
Aug. 22	do	438	3,889	5.60	11.12	21,792
Aug. 23	do	438	3,676	5.23	10.39	19,226
Aug. 23	do	438	3,654	5.19	10.34	18,963*s*
Sept. 14	H. C. Ritchie	404	2,493	3.78	7.42	9,425
Oct. 13	do	334	1,371	2.56	4.88	3,511
Oct. 31	do	356	1,466	2.88	5.25	4,226
Nov. 24	do	.....	.....	.....	5.55	1,100*x*
Dec. 14-15	W. K. Broughton	354	752	1.07	4.52	802

x Discharge estimated from previous measurements, thickness of ice and gauge height.
s Slope measurement.

DAILY GAUGE HEIGHT AND DISCHARGE of Red Deer river at Drumheller, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.28*b*	545	4.60	385	5.59	410	7.88	3,250	4.23	2,576	10.72	20,522
2	4.20	540	4.60	390	5.52	415	7.49	3,300	3.83	2,068	10.72	20,522
3	4.20*a*	530	4.64	392	5.44	421	7.31	3,420	4.02	2,306	9.22	15,172
4	4.20	518	4.64	392	5.44	440	7.04	3,580	5.72	5,109	9.00	14,440
5	3.97	478	4.66	392	5.40	470	7.01	3,400	5.66	4,979	9.42	15,843
6	3.87	440	4.70	392	5.34	500	6.91	3,000	5.54	4,730	9.82	17,220
7	4.15	450	4.70	390	5.29	540	6.86	2,660	5.47	4,590	9.23	15,205
8	4.10	455	4.73	390	5.28	575	6.81	2,780	5.30	4,270	8.56	13,000
9	4.10	458	4.73	392	5.60	610	6.91	3,100	5.33	4,324	8.27	12,064
10	4.05	460	4.76	397	6.08	660	6.91	3,220	4.62	3,133	8.26	12,032
11	4.10	462	4.79	400	6.60	720	6.91	3,420	4.56	3,040	8.16	11,712
12	4.20	460	4.79*a*	407	7.30	742	6.31	3,600	4.35	2,734	8.13	11,616
13	4.35	458	4.80*a*	415	6.45	695	6.91	3,720	4.35	2,734	7.93	10,976
14	4.30	457	4.81	425	6.16	670	6.91	3,840	4.05	2,344	7.66	10,119
15	4.32	445	5.39	455	6.01	750	6.81*b*	3,980	4.06	2,357	7.60	9,930
16	4.35*a*	435	6.99	485	5.86	980	5.26	4,198	4.05	2,344	8.09	11,488
17	4.38*a*	422	7.69	502	6.71	1,250	5.21	4,108	4.05	2,344	9.16	14,971
18	4.41*a*	412	7.86	511	6.81	1,300	5.16	4,024	4.05	2,344	8.73	13,553
19	4.45	403	7.69	512	6.25	1,340	5.04	3,826	4.04	2,331	9.00	14,440
20	4.45	393	7.64	490	6.25	1,370	4.72	3,298	4.02	2,306	8.78	13,715
21	4.45	386	7.09	460	6.34	1,400	4.64	3,166	4.02	2,306	9.59	16,426
22	4.48	380	7.05	450	6.46	1,450	4.49	2,935	4.00	2,280	10.00	17,855
23	4.65	375	7.42	461	6.71	1,470	4.31	2,681	4.13	2,446	8.92	14,176
24	4.55	368	7.33	492	6.91	1,500	4.15	2,472	4.20	2,536	7.82	10,624
25	4.55	360	7.16	490	8.63	1,900	4.06	2,357	4.20	2,536	7.25	8,887
26	4.50	359	6.92	480	12.96	2,700	3.94	2,205	4.22	2,562	7.13	8,552
27	4.54	357	6.83	462	10.81	2,800	3.83	2,068	5.24	4,162	7.17	8,663
28	4.54	348	6.72	440	9.56	2,850	3.95	2,217	5.65	4,958	7.63	10,024
29	4.60	352	6.58	418	9.06	2,900	4.17	2,498	6.00	5,730	10.09	18,179
30	4.60	366	.....	.....	8.98	3,000	4.31	2,681	7.76	10,434	9.10	14,770
31	4.60	379	.....	.....	8.28	3,100	.....	.....	8.86	13,978	.....	.....

a Gauge height interpolated.
b Ice conditions, January 1 to April 15.

DAILY GAUGE HEIGHT AND DISCHARGE of Red Deer river at Drumheller, for 1916 —*Concluded*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	8.91	14,143	7.04	8,308	6.22	6,249	5.21	4,108	5.93*b*	4,000	4.49*a*	850
2	8.90	14,110	6.41	6,714	6.43	6,764	5.27	4,216	5.85	3,600	4.47*a*	850
3	11.23	22,495	6.38	6,641	6.56	7,082	5.22	4,126	5.85	3,220	4.46*a*	835
4	11.57	23,817	6.30	6,445	7.09	8,443	5.25	4,180	5.85	2,960	4.44	830
5	11.53	23,662	6.56	7,082	12.00	25,490	5.28	4,234	5.81	2,700	4.43	820
6	11.33	22,884	7.20	8,745	12.77	28,485	5.22	4,126	5.79	2,440	4.48	818
7	11.73	24,440	6.88	7,884	11.67	24,206	5.16	4,021	5.43	2,200	4.46	825
8	9.86	17,360	6.64	7,280	11.30	22,767	5.14	3,991	4.92	1,960	4.34	820
9	9.66	16,667	6.04	5,824	9.58	16,391	5.11	3,941	4.34	1,720	4.32	803
10	9.11	14,804	6.24	6,298	9.13	14,870	5.06	3,859	4.26	1,640	4.30	790
11	8.90	14,110	6.36	6,592	8.02	11,264	5.04	3,826	4.21	1,590	4.30	795
12	8.50	12,805	6.30	6,445	8.76	13,650	4.93	3,645	4.42	1,535	4.29	795
13	8.20	11,840	6.03	5,800	8.55	12,967	4.92	3,629	4.53	1,480	4.30*a*	795
14	7.74	10,371	5.54	4,730	7.43	9,410	4.89	3,579	4.60*a*	1,415	4.31	802
15	7.30	9,030	5.34	4,342	7.29	9,002	4.88	3,562	4.67	1,380	4.42	818
16	7.13	8,552	5.20	4,090	7.00	8,200	4.81	3,446	5.29	1,300	4.47	825
17	6.74	7,530	5.05	3,842	6.66	7,330	5.05	3,842	6.07	1,260	4.72	832
18	6.19	6,176	4.34	2,721	6.31	6,469	5.07	3,875	6.37	1,225	4.77	840
19	6.71	7,455	5.88	5,460	6.20	6,200	5.57	4,790	6.10	1,205	4.84	845
20	7.88	10,816	12.94	29,146	6.11	5,989	5.65	4,958	6.08	1,180	4.92	845
21	6.94	8,041	13.19	30,119	5.86	5,415	5.66	4,979	5.82	1,160	4.87	825
22	6.58	7,130	11.86*a*	24,945	5.79	5,258	5.69	5,043	5.74	1,140	4.83	800
23	6.10	5,965	10.53*a*	19,802	5.73	5,129	5.70	5,065	5.79	1,120	4.79	778
24	6.98	8,147	9.20	15,105	5.42	4,490	5.74	5,151	5.55	1,100	4.76	760
25	7.69	10,213	9.05	14,605	5.36	4,378	5.78	5,237	5.37	1,065	4.72	740
26	8.27	12,064	8.00	11,200	5.31	4,288	5.79	5,258	4.92	1,015	4.67	730
27	8.21	11,872	7.62	9,993	5.21	4,108	5.75	5,173	4.64	965	4.62	710
28	7.89	10,848	7.23	8,831	5.25	4,180	5.69	5,043	4.51	915	4.62	700
29	7.53	9,713	6.74	7,530	5.25	4,180	5.69	5,043	4.40	870	4.62	700
30	7.58	9,868	6.46	6,837	5.21	4,108	5.47	4,590	4.49	845	4.62	698
31	7.50	9,620	6.23	6,274	.....	.....	5.27	4,216	.....	.....	4.62*b*	695

a Gauge height interpolated.
b Ice conditions, November 1 to December 31.

MONTHLY DISCHARGE of Red Deer river at Drumheller, for 1916

(Drainage area 8,874 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	545	348	428	0.048	0.06	26,317
February	512	385	437	0.049	0.05	25,137
March	3,100	410	1,288	0.145	0.17	79,196
April	4,198	2,068	3,167	0.357	0.40	188,450
May	13,978	2,068	3,771	0.425	0.49	231,870
June	20,522	8,552	13,556	1.539	1.72	806,638
July	24,440	5,965	12,792	1.441	1.66	786,549
August	30,119	2,721	9,666	1.089	1.25	594,339
September	28,485	4,108	9,892	1.115	1.25	588,615
October	5,258	3,446	4,347	0.490	0.56	267,286
November	4,000	845	1,674	0.189	0.21	99,610
December	850	695	793	0.089	0.10	48,760
The year	.....	.....	.....	.....	7.92	3,742,767

SOUTH SASKATCHEWAN RIVER DRAINAGE BASIN

General Description

The upper portion of this drainage basin will be dealt with in the description of the drainage basins of Bow, Little Bow, Oldman, Waterton, Belly and St. Mary rivers. These streams are all conjoined at a point known as the Grand Forks, to form the South Saskatchewan river. From the Grand Forks the river flows in a north and easterly direction to its junction with the North Saskatchewan river a short distance east of the city of Prince Albert. From this point onward the stream takes the name of the Saskatchewan river.

After the confluence of the Bow and Oldman rivers the stream receives comparatively little drainage, the principal tributaries being the Red Deer river, draining that portion of the basin between the North and the South Saskatchewan rivers, and Sevenpersons river and Swiftcurrent creek emptying into the main streams from the south. Descriptions of the drainage basins of all these streams are given elsewhere in this report.

The drainage basin of this stream is quite similar to that of all such streams which have their source in the mountains and flow across the prairies. The upper part of the basin has considerable fall, with rock and gravel formation and a good growth of timber. In contrast to this the prairie section of the basin is sparsely wooded, except along the banks of the stream, and the rock formation changes to earth; also the stream is more apt to change its channel, especially in times of flood. The high water occurs in the hot months of summer and is caused by the melting of the snow fields in the mountains. The low water occurs in the winter months when there is no melting snow to augment the stream flow. Unusually high water and floods follow rains of more than usual intensity in the upper section of the river. The South Saskatchewan river is much less liable to destructive floods than is the North Saskatchewan river.

In addition to the gauging stations on the tributaries, which are taken up in detail elsewhere in this report, there are two stations on the main stream. These stations are located at the cities of Medicine Hat and Saskatoon.

Up to the present the chief value of this stream has been a source of municipal water supply. There are no irrigation schemes or water power developments on the main stream.

The cities of Medicine Hat and Saskatoon derive their water supply from this stream. The South Saskatchewan is also being considered as a possible source of supply for the cities of Moose-jaw and Regina. In this connection surveys were carried out during 1913 by this department and also by the Provincial Government.

A special report upon the floods in this drainage basin was published in an Appendix to the 1915 report.

SOUTH SASKATCHEWAN RIVER AT MEDICINE HAT

Location.—On the NW. ¼ Sec. 31, Tp. 12, Rge. 5, W. 4th Mer., at the traffic bridge in the city of Medicine Hat.

Records available.—From May 31, 1911, to December 31, 1916.

Gauge.—Standard chain gauge; zero elevation maintained at 2,145.28 feet since establishment.

Bench-mark.—Permanent iron bench-mark; elevation 2,165.50 feet above sea-level (Geodetic Survey of Canada datum).

Channel.—Shifting, owing to sand bed.

Discharge measurements.—Made from traffic bridge.

Winter flow.—Observations taken during winter months.

Observer.—E. King.

DISCHARGE MEASUREMENTS of South Saskatchewan river at Medicine Hat, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 6	W. R. McCaffrey	454.0	2,255	0.67	2.54*b*	1,516
Jan. 19	do	444.0	2,281	0.84	3.01*b*	1,921
Feb. 5	H. W. Rowley	426.0	2,215	0.87	2.99*b*	1,938
Feb. 19	do	860.0	7,867	2.64	11.77*b*	20,751
Mar. 8	do	230.0	4,685	0.59	3.92*b*	2,768
April 5	E. J. Switzer	522.0	3,744	2.12	3.67	7,926
April 14	do	579.0	3,932	2.22	4.12	8,714
May 23	do	585.0	4,232	2.41	4.55	10,180
June 23-24	do	851.5	11,751	6.22	13.94	73,119
June 27	do	832.5	9,045	5.21	10.77	47,168
July 20-21	do	802.5	6,548	4.67	8.65	30,584
Aug. 19	do	718.5	4,460	2.66	5.14	11,856
Nov. 1	do	516.6	3,525	1.94	3.45	6,843
Dec. 5	W. M. Edwards-V. A. Newhall	.....	.....	.....	2.59*b*	1,800*e*
Dec. 20	E. J. Switzer	404.0	2,678	1.15	4.02*b*	3,068

b Ice conditions, Jan. 1 to Mar. 18, and Dec. 5 to 31.
e Discharge estimated, from field inspection.

DAILY GAUGE HEIGHT AND DISCHARGE of South Saskatchewan river at Medicine Hat, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.05*b*	1,570	2.74	1,890	.....	4,250	3.41	7,081	3.73	7,782	8.60	30,380
2	3.01	1,490	2.70	1,865	.....	3,790	3.47	7,207	4.00	8,460	9.25	35,085
3	2.87	1,475	2.72	1,815	.....	3,660	3.12	6,508	4.06	8,622	9.45	36,575
4	3.15	1,505	2.92	1,855	.....	3,490	3.24	6,740	3.66	7,618	8.70	31,090
5	2.85	1,535	2.99	1,938	.....	3,115	3.67	7,641	4.02	8,514	8.79	31,734
6	2.54	1,516	3.02	1,950	.....	2,920	3.51	7,291	4.61	10,211	9.38	36,051
7	2.41	1,500	3.14	1,965	.....	2,835	3.45	7,165	4.86	11,008	10.04	41,174
8	2.44	1,460	3.23	1,900	3.92	2,768	3.38	7,020	5.28	12,486	9.87	39,813
9	2.42	1,430	3.36	1,910	.....	2,865	3.49	7,249	6.52	17,880	9.26	35,159
10	2.46	1,400	3.28	1,985	.....	3,115	3.80	7,950	6.01	15,475	9.02	33,396
11	2.45	1,425	3.17	2,080	6.35	3,430	3.96	8,356	5.78	14,476	9.37	35,977
12	2.44	1,475	3.15	2,180	.....	3,910	3.99	8,434	5.36	12,788	9.57	37,482
13	2.47	1,555	3.45	2,300	.....	4,410	4.02	8,514	5.32	12,636	9.54	37,254
14	2.39	1,610	3.70	2,500	.....	5,050	4.12	8,784	4.73	10,586	9.03	33,469
15	2.46	1,705	4.24	2,900	5.52	6,350	4.22	9,056	4.95	11,310	8.75	31,448
16	2.58	1,780	4.79	4,300	5.01	7,100	3.88	8,150	4.98	11,412	8.90	32,525
17	2.80	1,840	4.80	6,000	5.17	7,800	3.38	7,020	4.45	9,720	9.68	38,326
18	2.97	1,885	7.35	12,500	5.21*b*	8,650	3.84	8,304	4.15	8,865	11.30	51,555
19	3.01	1,921	11.77	20,751	4.23	9,084	3.76	7,854	4.11	8,757	12.05	57,742
20	3.03	1,945	9.60	12,300	4.10	8,730	3.44	7,144	4.39	9,541	12.75	63,517
21	3.02	1,915	8.47	10,500	4.09	8,703	3.10	6,470	4.24	9,112	13.63	70,778
22	2.96	1,845	8.06	9,500	4.23	9,084	3.22	6,700	4.32	9,338	13.88	72,840
23	2.52	1,720	.....	8,800	3.93	8,278	3.34	6,940	4.55	10,025	14.47	77,708
24	2.56	1,670	.....	8,000	3.90	8,200	2.98	6,242	5.13	11,938	13.42	69,045
25	2.42	1,655	.....	7,200	3.81	7,975	3.31	6,880	5.10	11,830	11.56	53,700
26	2.51	1,690	.....	6,200	3.98	8,408	3.36	6,980	5.28	12,486	11.15	50,317
27	2.59	1,690	.....	5,650	3.98	8,408	2.98	6,242	5.64	13,894	10.77	47,183
28	2.34	1,635	.....	5,250	4.26	9,168	2.98	6,242	6.24	16,528	10.90	48,255
29	2.20	1,605	.....	4,700	3.68	7,664	3.12	6,508	6.52	17,880	12.02	57,495
30	2.66	1,640	.....	.....	3.36	6,980	3.53	7,333	6.22	16,434	14.23	75,728
31	2.74	1,790	.....	.....	3.41	7,081	.....	.....	6.82	19,416	.....	.....

b Ice conditions from Jan. 1 to March 18. Discharge determined from winter hydrograph.

DAILY GAUGE HEIGHT AND DISCHARGE of South Saskatchewan river at Medicine Hat, for 1916
—*Concluded*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	14.09	74,572	5.88	14,904	5.23	13,301	3.71	7,734	3.45	7,165	2.31	5,056
2	12.76	63,600	5.56	13,570	5.26	12,412	3.61	7,503	.....	6,904*e*	2.48	5,336
3	11.82	55,845	5.50	13,330	5.16	12,046	4.12	8,784	.....	6,642*e*	2.60	5,540
4	12.16	58,650	5.23	12,301	5.46	13,174	.....	8,518*e*	.....	6,381*e*	2.46	5,302
5	12.75	63,517	5.29	12,523	5.94	15,166	3.92	8,252	.....	6,119*e*	2.59*b*	4,750
6	12.37	60,383	.....	12,675*e*	6.89	19,787	3.92	8,252	.....	5,858*e*	2.38	4,470
7	11.53	53,453	5.37	12,826	8.68	30,948	3.89	8,175	.....	5,597*e*	2.30	4,270
8	10.87	48,008	5.35	12,750	8.22	27,774	3.63	7,549	.....	5,335*e*	3.60	3,920
9	10.25	42,892	5.28	12,486	7.48	23,112	3.53	7,333	.....	5,071*e*	3.68	3,700
10	10.17	42,234	5.33	12,674	6.83	19,469	3.50	7,270	.....	4,813*e*	3.58	3,400
11	10.35	43,717	5.34	12,712	6.06	15,700	3.57	7,417	.....	4,551*e*	3.56	3,170
12	10.41	44,212	5.76	14,392	5.89	14,947	2.86	6,014	.....	4,290*e*	3.48	2,980
13	10.24	42,810	6.54	17,980	5.76	14,392	4.12	8,784	.....	4,028*e*	3.37	2,830
14	9.90	40,050	6.19	16,294	5.59	13,690	3.21	6,680	1.37	3,767	3.28	2,710
15	9.68	38,326	5.64	13,894	4.98	11,412	3.30	6,860	2.27	4,992	3.13	2,650
16	9.54	37,254	5.33	12,674	4.93	11,242	3.30	6,860	1.83	4,342	3.08	2,650
17	9.32	35,604	5.06	11,690	5.34	12,712	3.25	6,760	2.58	5,506	3.00	2,730
18	8.68	30,948	4.96	11,344	5.31	12,598	3.24	6,740	2.38	5,168	2.96	2,870
19	8.64	30,664	5.14	11,974	5.21	12,227	3.24	6,740	2.40	5,200	3.04	3,010
20	8.66	30,806	5.64	13,894	4.20	9,000	3.21	6,680	2.43	5,251	4.02	3,068
21	8.64	30,664	9.80	39,260	4.46	9,750	3.50	7,270	3.33	6,920	4.08	3,070
22	8.18	27,508	8.26	28,042	4.46	9,750	3.57	7,417	3.33	6,920	3.96	3,080
23	7.60	23,830	7.29	22,003	4.40	9,570	3.43	7,123	2.86	6,014	4.08	3,000
24	7.27	21,889	6.57	18,130	4.23	9,084	4.22	9,056	2.98	6,242	3.63	2,740
25	7.18	21,378	6.31	16,858	4.15	8,865	3.43	7,123	2.78	5,864	3.63	2,600
26	6.93	20,002	5.84	14,732	4.05	8,595	3.40	7,060	2.98	6,242	3.58	2,570
27	6.73	18,946	6.41	17,339	3.94	8,304	3.57	7,417	2.98	6,242	3.50	2,710
28	6.56	18,080	5.80	14,560	3.97	8,382	3.05	6,375	2.73	5,774	3.55	2,690
29	6.27	16,669	5.82	14,646	3.71	7,734	4.69	10,459	2.46	5,302	3.49	2,380
30	6.35	17,050	5.73	14,266	3.57	7,417	3.55	7,375	2.42	5,234	3.47	2,260
31	6.12	15,972	5.53	13,450	.....	.....	3.45	7,165	.....	.....	2.93*b*	2,250

b Ice conditions, Dec. 5 to 31. Discharge determined from winter hydrograph.
e Discharge estimated.

MONTHLY DISCHARGE of South Saskatchewan river at Medicine Hat, for 1916

(Drainage area 20,870 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	1,945	1,400	1,641	0.079	0.09	100,901
February	20,751	1,815	5,265	0.252	0.27	302,847
March	9,168	2,768	6,041	0.289	0.33	371,446
April	9,056	6,242	7,334	0.351	0.39	436,406
May	19,416	7,618	11,840	0.567	0.65	728,012
June	77,708	30,380	46,427	2.220	2.48	2,762,593
July	74,572	15,972	37,727	1.810	2.09	2,319,743
August	39,260	11,344	15,490	0.742	0.86	952,443
September	30,948	7,417	13,419	0.643	0.72	798,487
October	10,459	6,375	7,508	0.360	0.42	461,648
November	7,165	3,767	5,591	0.268	0.30	332,688
December	5,540	2,250	3,347	0.160	0.18	205,799
The year	.....	.....	.....	.....	8.78	9,773,013

MEAN MONTHLY DISCHARGE in Second-feet of South Saskatchewan river at Medicine Hat

MONTH	1910-11	1911-12	1912-13	1913-14	1914-15	1915-16	1916-17	Mean in Sec.-ft.	Mean in Acre-ft.
October			6,065	5,873	7,600	7,112	7,508	6,832	420,063
November		4,228	5,099	4,647	5,556	4,537	5,591	4,943	294,132
December		2,501	2,376	3,117	2,251	2,378	3,347	2,662	163,661
January		1,663	1,652	2,547	2,305	1,641		1,962	120,613
February		2,134	2,013	1,576	1,982	5,265		2,594	146,998
March		1,792c	2,059	4,022	6,176	6,041		4,574	281,274
April		6,746b	8,977	5,754	5,345	7,334		6,852	407,753
May		12,887d	12,412	14,679	19,354	11,840		14,571	895,951
June	32,694	19,121	29,747	19,831	32,275	46,427		30,016	1,786,065
July	25,825	21,513	16,907	14,122	32,997	37,727		24,848	1,527,880
August	18,545a	13,292	12,260	6,590	18,470	15,490		13,220	812,893
September		8,698	7,592	4,486	8,815	13,419		8,602	511,857
Total in Acre-ft.	4,489,732	5,387,719	6,475,036	5,286,194	8,685,559	9,626,366			7,369,140

a 1-26.
b 10-19.
c 1-24 and 27.
d 3-31.

SOUTH SASKATCHEWAN RIVER AT SASKATOON

Location.—On SW. ¼ Sec. 28, Tp. 36, Rge. 5, W. 3rd Mer., at the Canadian Northern railway bridge in the city of Saskatoon.

Records available.—May 27, 1911, to December 31, 1916.

Gauge.—Chain. Elevation of zero maintained at 1,543.22 feet, since establishment.

Bench-marks.—Painted mark on side of downstream end of left abutment; elevation 1,568.98 referred to a bench-mark on top of hydrant three hundred feet northeast; elevation 1,586.94 feet (Geodetic survey datum) and to Geodetic B.M. No. 30 brass plug in south end Canadian Northern railway station; elevation 1,593.14 feet.

Channel.—Permanent.

Discharge measurements.—From bridge.

Observer.—A. B. Hay.

DISCHARGE MEASUREMENTS of South Saskatchewan river at Saskatoon, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 3, 4	F. R. Shenstone	493	2,039	1.52	5.32	3,089
Jan. 27, 28, 29, 31	do	623	1,614	1.20	4.78	1,937
Mar. 27	do				11.10	16,000e
Mar. 30	do				10.87	19,000e
April 10	do	785	8,548	2.73	12.05	23,374
May 23	do	532	4,254	3.08	6.29	13,134
June 15, 16	do	802	8,978	5.36	12.46	48,174
June 28	do	812	11,449	6.31	15.82	72,335
July 1	do	802	9,974	5.58	14.00	55,740
July 11	F. R. Shenstone and J. R. Estey	825	12,552	6.11	17.08	77,744
July 14	J. R. Estey	809	10,298	5.77	14.43	59,430
July 21	do	792	8,781	5.29	12.46	46,524
Aug. 4	do	747	6,268	4.41	9.20	27,657
Aug. 28	F. R. Shenstone	792	8,508	5.52	11.93	46,998
Sept. 19	do	752	6,568	4.78	9.38	31,405
Oct. 30-31	do	627	4,303	3.33	6.70	14,334
Nov. 21-22	do	450	2,792	1.70	4.56	4,764

e Estimated from field inspection.

DAILY GAUGE HEIGHT AND DISCHARGE of South Saskatchewan river at Saskatoon, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	5.92*b*	3,300	4.75	1,900	5.54	5,000	10.83	20,000	5.55	10,088	6.96	15,870
2	5.55	3,200	4.75	2,000	5.95	6,800	10.89	20,000	5.46	9,795	7.19	16,976
3	5.36	3,100	4.70	2,000	9.14	16,200	11.77	20,200	5.45	9,762	7.62	19,100
4	5.24	3,100	4.71	2,000	9.70	17,600	12.12	20,300	5.17	8,852	8.19	22,096
5	5.18	3,050	4.68	1,950	9.61	17,400	12.44	20,300	5.09	8,592	8.72	24,960
6	5.17	3,050	4.67	1,900	9.39	17,200	12.31	20,400	5.10	8,625	12.92	49,780
7	5.16	3,000	4.67	1,900	9.16	16,900	11.72	20,800	5.12	8,690	13.41	53,016
8	5.15	3,000	4.65	1,900	8.73	16,500	11.30	21,000	5.39	9,568	12.90	49,650
9	5.16	2,900	4.65	2,000	8.50	16,100	11.30	22,000	5.82	11,130	12.06	44,360
10	5.18	2,850	4.61	2,000	8.34	15,600	12.20	22,500	6.02	11,930	12.44	46,660
11	5.08	2,800	4.56	2,100	8.08	15,200	13.10	23,300	5.72	10,730	13.58	54,300*s*
12	4.99	2,750	4.51	2,100	7.70	14,900	13.22	23,700	5.88	11,370	13.74	55,700
13	4.96	2,700	4.58	2,100	7.40	14,600	12.00	24,000	6.46	13,690	13.05	51,450
14	4.84	2,650	4.50	2,200	7.16	14,200	10.30	30,000	6.95	15,825	12.56	48,500
15	4.73	2,600	4.52	2,200	6.90	13,900	9.48*b*	29,200	8.11	21,666	12.36	47,600
16	4.66	2,550	4.55	2,200	6.75	13,500	11.20	39,200	8.17	21,989	12.62	49,200
17	4.58	2,500	4.56	2,200	6.40	13,200	9.54	29,537	7.73	19,650	12.88	51,200
18	4.40	2,450	4.55	2,200	6.33	13,200	8.98	26,390	7.75	19,750	12.32	47,700
19	4.30	2,400	4.53	2,150	6.42	13,600	8.18	22,042	7.48	18,400	11.95	45,600
20	4.27	2,350	4.54	2,200	6.83	14,000	7.48	18,400	7.21	17,074	11.85	45,175
21	4.25	2,300	4.61	2,400	7.34	14,600	7.14	16,732	6.97	15,915	11.94	45,800
22	4.25	2,250	4.66	2,700	8.96	15,000	6.90	15,600	6.74	14,880	13.36	55,200
23	4.31	2,200	4.75	3,000	11.79	15,600	6.58	14,170	6.70	14,700	15.47	69,650
24	4.41	2,150	4.75	3,100	11.52	16,300	5.58	10,185	6.27	12,930	17.08	80,700
25	4.48	2,100	4.80	3,200	11.44	16,900	5.60	10,250	6.03	11,970	17.83	85,900
26	4.64	2,000	4.86	3,400	11.40	17,400	6.36	13,090	6.18	12,570	18.38	89,800
27	4.81	1,950	4.95	3,700	11.12	18,000	6.01	11,890	6.14	12,410	17.41	83,150
28	4.80	1,950	5.08	4,000	10.73	18,400	5.87	11,330	6.20	12,650	15.72	71,800
29	4.79	1,900	5.20	4,400	10.63	18,800	5.55	10,088	6.32	13,130	14.91	66,000
30	4.76	1,900	.....	.....	10.83	19,000	5.59	10,218	6.43	13,570	.....	61,462*se*
31	4.75	1,900	.....	.....	10.79	20,000	.....	.....	6.94	15,780	.....	.....

b Ice conditions from January 1 to April 14.
s Shifting conditions from June 11 to 30.
e Discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of South Saskatchewan river at Saskatoon, for 1916—*Concluded*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	14.00	56,925	9.45	29,031	9.84	33,861	7.03	16,634	6.62	14,340	6.34	5,180
2	14.03	57,123	9.25	27,906	9.56	32,139	7.03	16,634	6.55	14,050	6.94	5,230
3	16.40	73,250	8.94	26,170	9.10	29,312	7.02	16,573	6.64	14,430	7.02	5,300
4	19.30	93,042	8.97	26,335	8.94	28,332	6.79	15,295	6.50	13,850	7.03	5,370
5	18.36	86,627	9.20	27,625	8.77	27,291	6.73	14,965	6.67	14,565	7.16	5,400
6	16.63	74,820	9.05	26,781	8.45	25,331	6.74	15,020	6.76	14,970	7.37	5,460
7	15.64	68,063	8.85	25,675	8.21	23,861	6.72	14,910	6.49	13,810	7.52	5,500
8	16.07	70,998	8.47	23,601	8.11	23,249	6.77	15,185	6.48	13,775	7.75	5,540
9	17.34	79,665	8.40	23,225	8.10	23,188	6.63	14,385	6.26*b*	11,700	7.91	5,590
10	17.76	82,532	8.19	22,096	8.45	25,331	6.84	15,330	6.00	10,000	8.03	5,600
11	16.71	75,366	8.18	22,042	11.00	40,995	6.76	14,970	5.29	8,800	8.46	5,600
12	15.59	67,722	8.17	21,988	13.00	53,750	6.76	14,970	4.38	7,000	8.63	5,600
13	14.85	62,671	8.12	21,720	12.55	50,775	6.71	14,745	4.15	6,100	8.70	5,580
14	14.40	59,600	8.27	22,526	11.74	45,580	6.65	14,475	4.15	5,550	8.64	5,500
15	14.36	59,330	8.24	22,365	11.16	41,979	6.50	13,850	4.17	5,380	8.61	5,350
16	14.37	59,398	8.05	21,344	10.40	37,305	6.40	13,450	4.22	5,230	8.55	5,300
17	13.91	56,329	7.99	21,021	9.91	34,292	6.52	13,930	4.45	5,100	8.40	5,200
18	13.50	53,612	8.23	22,311	9.70	33,000	6.42	13,530	4.58	4,950	8.35	5,100
19	13.15	51,294	8.66	24,630	9.41	31,216	6.50	13,850	4.63	4,850	8.35	5,000
20	12.84	49,260	8.46	23,545	9.02	28,822	6.40	13,450	4.36	4,830	8.27	4,900
21	12.41	46,465	8.06	21,397	8.58	26,128	6.10	12,250	4.48	4,760	.....	4,750*e*
22	12.05	44,300	7.72	19,600	8.52	25,760	5.96	11,690	4.65	4,800	.....	4,670*e*
23	11.59	41,540	7.40	18,000	8.57	26,067	5.95	11,650	4.21	4,820	.....	4,550*e*
24	11.40	40,400	7.23	17,171	8.45	25,331	5.95	11,650	4.26	4,820	7.70	4,380
25	11.36	40,160	7.32	17,610	8.14	23,432	5.98	11,770	4.36	4,830	.....	4,250*e*
26	11.34	40,040	12.14	46,400*s*	7.61	20,186	6.08	12,170	4.60	4,860	7.72	4,200
27	11.07	38,420	12.87	45,800*s*	7.58	20,003	6.20	12,650	4.84	4,900	7.78	4,090
28	10.70	36,238	11.72	45,455	7.45	19,206	6.35	13,250	5.25	4,930	7.78	3,950
29	10.30	33,888	11.09	41,548	7.34	18,532	6.50	13,850	5.19	4,980	7.75	3,900
30	9.85	31,281	10.57	38,350	7.15	17,369	6.62	14,340	5.82	5,020	7.55	3,800
31	9.70	30,437	9.97	34,660	.....	.....	6.72	14,790	.....	.....	7.60*b*	3,680

b Ice conditions November 9 to December 31.
s Shifting conditions from August 26-27.
e Discharge estimated.

Monthly Discharge of South Saskatchewan river at Saskatoon, for 1916

(Drainage area 64,500x square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	3,300	1,900	2,545	0.039	0.04	156,486
February	4,400	1,900	2,486	0.038	0.04	142,996
March	20,000	5,000	15,342	0.238	0.27	943,343
April	39,200	10,088	19,894	0.308	0.34	1,183,775
May	21,989	8,592	13,474	0.209	0.24	828,484
June	89,800	15,870	51,612	0.800	0.89	3,071,128
July	93,042	30,437	56,800	0.881	1.02	3,492,496
August	46,400	17,171	26,707	0.414	0.48	1,642,150
September	53,750	17,369	29,721	0.461	0.51	1,768,522
October	16,634	11,650	14,071	0.218	0.25	865,192
November	14,970	4,760	8,067	0.125	0.14	480,020
December	5,600	3,680	4,952	0.077	0.09	304,486
The year					4.31	14,879,078

x The drainage area given in this table is only approximate. It must be remembered that the greater part of the run-off at this station is derived from the eastern slope of the Rocky mountains, and must not be used to base estimates of run-off of other streams in this territory.

Mean Monthly Discharge in Second-feet of South Saskatchewan river at Saskatoon

Month	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
Oct.		8,476[b]	9,293	7,909	10,315	12,714	14,071	10,860	667,777
Nov.		2,434[c]	7,414	6,079	8,151	6,118	8,067	7,166	426,395
Dec.		3,945	[d]	3,752	3,204	3,855	4,952	3,942	240,871
Jan.		1,686	1,247	2,702	3,379	2,545		2,312	142,147
Feb.		2,297	1,981	2,130	2,345	2,486		2,248	126,733
March		2,304	2,432	3,038	3,318	15,342		5,287	325,073
April		14,152	15,852	6,319	13,472	19,894		13,938	829,361
May	22,688[a]	14,737	11,937	13,876	19,813	13,474		14,767	908,017
June	32,477	23,204	32,436	26,375	36,144	51,612		33,708	2,005,767
July	27,684	33,602	24,232	22,694	60,566	56,800		37,596	2,311,716
August	23,503	23,681	14,854	9,762	33,704	26,707		22,035	1,354,902
Sept.	20,357	16,359	9,143	7,945	16,357	29,721		16,647	990,566
Total in Acre-ft.	6,471,251	8,617,256	7,903,464	6,809,595	12,798,628	14,612,214			10,329,325

[a] —28 to 31.
[b] —1 to 19.
[c] —20 to 30.
[d] —Not sufficient data to compute discharge for December.

BOW RIVER DRAINAGE BASIN

General Description

Bow river rises in lakes Bow and Hector, which are situated in the Rocky Mountains park, north of the main line of the Canadian Pacific railway and immediately east of the "Great Divide," the elevations of which lakes are respectively 6,420 and 5,694 feet above mean sea-level. The river flows in a south and easterly direction to the city of Calgary, where it takes a big bend to the south and then continues in a south and easterly direction to its confluence with the Oldman river at the "Grand Forks." Below this point the united stream is known as the South Saskatchewan river.

Bow river has a large number of tributaries in the western part of its course. Of these the principal are the Pipestone, Cascade and Ghost rivers draining the northern slopes of the basin, and the Spray, Kananaskis, Elbow, Sheep and Highwood rivers draining the southern slopes. Below the mouth of Highwood river very little drainage reaches Bow river, Crowfoot creek being the largest tributary, and so it appears that most of the water supply is derived from the run-off from mountains and foot-hills.

As a result, Bow river possesses a normally steady flow throughout the year, but is subject to sudden freshets caused by melting snow and heavy rains in the mountains.

The minimum flow occurs in the frozen season, when there is little run-off from the snow-fields in the western part of the drainage basin.

The valley of the Bow is deep and well defined throughout its course. In the mountain section it is comparatively narrow and is very heavily timbered, while its bed is stony and its banks high and rocky. The nature of the valley gradually changes as it approaches the prairies, when it widens out, becomes of a clay formation and is devoid of trees, the actual bed consisting for the most part of gravel. The water is clean and pure. A large quantity of water is diverted from the Bow river for irrigation purposes. The two chief users are the Department of Natural Resources, Canadian Pacific Railway company, and the Southern Alberta Land company.

The Department of Natural Resources diverts water at two points, one in the city of Calgary, and the other three miles southwest of Bassano. The first system has been in operation for several years and distributes water over the western section of the company's irrigation block, which extends east as far as Cluny. The works at Bassano comprise a very large earth-filled dam and concrete spillway, which were completed in 1913. This system is to serve the eastern section of the company's irrigation block, which extends east from Bassano. In all, it is proposed to irrigate about 625,000 acres of land.

The Southern Alberta Land company has a dam and reservoir near Namaka. It is proposed to irrigate by this system about 200,000 acres.

There are many favourable sites for power development on the Bow river, but only one company has, up to the present, developed power. The Calgary Power company has two plants, one at Kananaskis falls, at the confluence of the Kananaskis and Bow rivers, near Seebe station; the other at Horseshoe falls, two miles below. The latter plant has been in operation for several years and has, when sufficient water is available, a capacity of 19,500 horse-power. The dam at Kananaskis falls was completed in 1913, and this plant has a rated capacity of 11,600 horse-power. Nearly all the power developed is used by the city of Calgary.

The city of Calgary obtains most of its domestic water supply from the Elbow river. The intake is about twelve miles southwest of Calgary, above which point the course of the river is through a wild and unsettled country, where there is no possibility of human contamination.

The town of Bassano obtains its domestic water supply from the Bow river at the Canadian Pacific Railway company's dam, three miles southwest of the townsite.

A special report upon the floods in this drainage basin was published in an Appendix to the 1915 report.

BATH CREEK NEAR LAKE LOUISE

Location.—On the NE. ¼ Sec. 32, Tp. 28, Rge. 16, W. 5th Mer., and one and one-quarter miles west of Lake Louise station, near the mouth of the stream.

Records available.—May 25 to September 30, 1913. Discharge measurements only in 1914. May 23, 1915, to December 31, 1916.

Gauge.—Vertical staff. Elevation of zero maintained at 89.59 feet during 1913. Elevation of zero maintained at 90.54 feet during 1914-15-16.

Bench-mark.—Downstream corner of right concrete abutment; assumed elevation 100.00 feet.

Channel.—Gravel; shifting.

Discharge measurements.—Made by wading.

Observers.—D. Prescott, January 1 to March 11; J. Charyk, June 5 to December 31.

Discharge Measurements of Bath creek near Lake Louise, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 19	J. M. Paul	27.0	13.7	1.01	0.99	13.9
Feb. 15	H. C. Ritchie	28.0	12.8	0.84	0.95	10.7
Feb. 29	do	26.0	13.3	0.86	0.94	11.4
Mar. 14	do	26.5	14.0	0.90	0.95	12.7
Mar. 29	do	27.0	14.0	0.82	0.93	12.5
April 19	do	26.4	13.9	0.95	0.97	13.2
May 10	do	27.7	19.3	1.56	1.30	30.0
May 31	do	28.0	22.5	1.74	1.35	39.0
June 23	do	43.0	51.0	4.07	2.25	207.0
July 7	do	45.0	59.6	4.80	2.51	286.0
July 27	do	43.0	51.0	4.08	2.24	208.0
Aug. 15	do	42.0	54.2	4.12	2.30	223.0
Sept. 5	do	42.0	49.8	4.05	2.25	202.0
Oct. 3	do	29.4	24.0	1.97	1.44	47.0
Oct. 26	do	30.0	23.3	1.66	1.36	39.0
Nov. 17	do	27.0	18.0	1.26	1.15	23.0
Dec. 6	do	28.0	15.0	1.03	1.00	15.4

Daily Gauge Height and Discharge of Bath creek near Lake Louise, for 1916

Day	January		February		March		June		July	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.05	17.8	0.98	14.8	0.94	13.4			2.68	346
2	1.05	17.8	0.98	14.8	0.94	13.4			2.70	353
3	1.05	17.8	0.98	14.8	0.94	13.4			2.72	360
4	1.04	17.3	0.98	14.8	0.96	14.1			2.74	367
5	1.03	16.8	0.98	14.8	0.96	14.1	1.49	48	2.67	343
6	1.03	16.8	0.98	14.8	0.94	13.4	1.42	41	2.61	322
7	1.03	16.8	0.96	14.1	0.94	13.4	1.43	42	2.47	275
8	1.03	16.8	0.96	14.1	0.94	13.4	1.45	44	2.65	336
9	1.02	16.4	0.96	14.1	0.94	13.4	1.49	48	2.89	418
10	1.02	16.4	0.96	14.1	0.94	13.4	1.44	43	2.98	448
11	1.02	16.4	0.96	14.1	0.97	14.4	1.45	44	3.01	458
12	1.00	15.5	0.96	14.1			1.51	50	3.03	465
13	1.00	15.5	0.96	14.1			1.55	54	3.29	554
14	1.00	15.5	0.94	13.4			1.65	66	2.97	445
15	1.00	15.5	0.96	14.1			1.90	109	2.75	370
16	0.98	14.8	0.98	14.8			2.11	162	2.80	387
17	0.97	14.4	1.00	15.5			2.18	183	2.82	394
18	0.97	14.4	1.00	15.5			2.95	438	2.98	448
19	0.99	15.2	0.98	14.8			3.31	560	2.73	363
20	0.99	15.2	0.95	13.8			3.51	628	2.51	288
21	0.99	15.2	0.95	13.8			2.96	441	2.43	261
22	0.90	12.0	0.97	14.4			2.73	363	2.45	268
23	0.99	15.2	0.97	14.4			2.44	265	2.37	241
24	1.02	16.4	0.97	14.4			2.50	285	2.29	216
25	1.00	15.5	0.97	14.4			2.69	350	2.26	207
26	1.00	15.5	0.97	14.4			2.73	363	2.23	198
27	1.00	15.5	0.97	14.4			2.86	407	2.21	192
28	1.00	15.5	0.98	14.8			2.93	431	2.21	192
29	1.00	15.5	0.94	13.4			2.86	407	2.22	195
30	1.00	15.5					2.70	353	2.37	241
31	1.00	15.5							2.30	219

No observer March 12 to June 4.

DAILY GAUGE HEIGHT AND DISCHARGE of Bath creek near Lake Louise, for 1916—*Concluded.*

Day	August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.34	232	2.56	305	1.49	48	1.34	35.0	1.10	20.0
2	2.34	232	2.53	295	1.47	46	1.32	33.0	1.12	21.0
3	2.51	288	2.46	271	1.44	43	1.22	27.0	1.12	21.0
4	2.47	275	2.43	261	1.27	30	1.31	32.0	1.11	21.0
5	2.31	222	2.45	268	1.35	36	1.23	27.0	1.11	21.0
6	2.28	213	2.23	198	1.41	40	1.22	27.0	1.00	15.5
7	2.25	204	2.16	177	1.39	39	1.03	16.8	1.06	18.2
8	2.29	216	2.06	148	1.36	36	1.17	24.0	1.06	18.2
9	2.35	235	2.03	140	1.36	36	1.17	24.0	1.07	18.6
10	2.33	229	1.93	116	1.35	36	1.12	21.0	1.03	16.8
11	2.27	210	1.90	109	1.35	36	1.00	15.5	1.04	17.3
12	2.21	192	1.89	107	1.34	35	1.02	16.4	1.06	18.2
13	2.20	189	1.81	91	1.34	35	1.12	21.0	1.06	18.2
14	2.23	198	1.76	83	1.36	36	1.10	20.0	1.05	17.8
15	2.30	219	1.75	81	1.37	37	1.10	20.0	1.05	17.8
16	2.31	222	1.73	78	1.96	123	1.16	23.0	1.05	17.8
17	2.22	195	1.74	79	2.06	148	1.13	23.0	1.03	16.8
18	2.17	180	1.73	78	1.72	76	1.15	23.0	1.01	16.0
19	2.20	189	1.72	76	1.63	64	1.14	22.0	1.05	17.8
20	2.16	177	1.71	75	1.46	45	1.13	22.0	1.04	17.3
21	2.01	135	1.71	75	1.45	44	1.11	21.0	1.01	16.0
22	1.95	120	1.73	78	1.42	41	1.15	23.0	1.00	15.5
23	2.03	140	1.72	76	1.41	40	1.12	21.0	1.00	15.5
24	2.20	189	1.74	79	1.39	39	1.10	20.0	0.99	15.2
25	2.17	180	1.75	81	1.38	38	1.13	22.0	0.98	14.8
26	2.21	192	1.68	70	1.39	39	1.13	22.0	1.00	15.5
27	2.21	192	1.51	50	1.37	37	1.15	23.0	0.97	14.4
28	2.23	198	1.55	54	1.30	32	1.14	22.0	0.98	14.8
29	2.22	195	1.54	53	1.29	31	1.12	21.0	0.94	13.4
30	2.27	210	1.56	55	1.29	31	1.10	20.0	0.98	14.8
31	2.61	322	.....	.....	1.36	36	.....	.....	0.96	14.1

MONTHLY DISCHARGE of Bath creek near Lake Louise, for 1916

(Drainage area 31 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	17.8	12.0	26.0	0.839	0.97	1,599
February	15.5	13.4	14.4	0.464	0.50	828
March (1-11)	14.4	13.4	13.6	0.439	0.18	297
April	.....	.....	.....	.....	.....	.....
May	.....	.....	.....	.....	.....	.....
June (5-30)	628.0	41.0	239.0	7.710	7.46	12,325
July	554.0	192.0	328.0	10.581	12.20	20,168
August	322.0	120.0	206.0	6.645	7.66	12,666
September	305.0	50.0	124.0	4.000	4.46	7,379
October	148.0	30.0	46.0	1.484	1.71	2,828
November	35.0	15.5	23.0	0.742	0.83	1,369
December	21.0	13.4	17.1	0.552	0.64	1,051
The period	.....	.....	.....	.....	36.61	60,510

BOW RIVER NEAR LAKE LOUISE

Location.—On the SE. ¼ Sec. 28, Tp. 28, Rge. 16, W. 5th Mer., one-half mile east of Lake Louise station, at the confluence of the Bow and Pipestone rivers.

Records available.—January 1, 1911, to December 31, 1916. In 1910 discharge measurements were obtained.

Gauge.—Chain; elevation of zero maintained at 4,931.72 feet since establishment.

Bench-mark.—Permanent iron bench-mark on the left bank; elevation 4,942.82 feet above mean sea-level (Canadian Pacific railway datum).

Channel.—Permanent.

Discharge measurements.—Made from a cable or by wading.

Floods.—The highest gauge height recorded was 9.54 feet on June 26, 1915. Stream did not overflow banks.

Observer.—E. Braund.

DISCHARGE MEASUREMENTS of Bow river near Lake Louise, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 19	J. M. Paul	32.0	31.0	1.65	5.21	51
Jan. 19	do	37.0	28.7	2.03	5.21	58
Feb. 15	H. C. Ritchie	48.0	35.0	1.66	6.64	58
Feb. 29	do	48.0	32.0	1.54	4.85	49
Mar. 14	do	48.0	38.3	1.89	7.02	72
Mar. 28	do	48.0	38.8	1.92	4.60	75
April 18	do	50.0	35.0	1.67	4.25	58
May 9	do	55.0	92.0	2.12	5.53	195
May 30	do	63.0	118.0	2.68	5.89	317
June 27	do	76.0	320.0	6.65	8.80	2,128
July 6	do	74.5	235.5	5.16	7.67	1,215
Aug. 15	do	73.0	188.7	5.10	7.12	962
Sept. 4	do	73.0	214.0	4.93	7.38	1,053
Oct. 2	do	60.0	75.2	2.53	5.45	190
Oct. 26	do	55.0	69.5	2.55	5.40	177
Nov. 17	do	50.0	46.0	2.01	6.30	92
Dec. 6	do	51.0	44.9	1.77	6.13	80

DAILY GAUGE HEIGHT AND DISCHARGE of Bow river near Lake Louise, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1....	5.66*b*	79	5.13	52	4.80	49	4.31	68	4.76	89	5.90	299
2....	5.40	77	4.95	52	4.72	49	4.28	66	4.84	97	5.89	296
3....	5.47	77	4.80	53	4.64	50	4.25	65	5.08	130	5.89	296
4....	5.57	77	4.80	52	4.70	51	4.27	65	5.44	187	5.85	284
5....	5.42	76	4.80	52	4.98	51	4.27*a*	64	5.74	253	6.06	354
6....	5.40	75	4.76	51	4.79	51	4.27*a*	64	5.84	281	6.10	368
7....	5.36	73	4.54	51	4.73	51	4.25*a*	64	5.84	281	6.04	346
8....	5.30	72	4.73	52	4.81	52	4.24*a*	64	5.65	230	6.10	368
9....	5.27	71	4.71	52	4.99	54	4.23*a*	63	5.51	200	6.20	406
10....	5.27	69	4.72	52	5.38	57	4.22*a*	62	5.46	191	6.24	422
11....	5.37	67	4.72	53	6.59	60	4.21*a*	61	5.25	156	6.16	391
12....	5.18	66	4.63	54	7.16	64	4.20*a*	61	5.22	151	6.25	426
13....	5.07	64	6.58	56	6.96	68	4.20*a*	60	5.18	145	6.40	489
14....	4.99	63	6.89	57	6.82*a*	72	4.20*a*	59	5.25	156	6.57	572
15....	5.04	61	6.64	58	6.70*a*	86	4.20*a*	59	5.22	151	7.06	872
16....	5.04	60	6.83	58	6.68*a*	90	4.19*a*	59	5.44	187	7.79	1,432
17....	5.19	60	7.30	58	6.50*a*	92	4.18*ab*	58	5.49	196	8.52	2,128
18....	5.22	59	7.17	58	6.20*a*	91	4.16	55	5.66	232	9.07	2,666
19....	5.20	58	7.36	56	6.07	91	4.16	55	5.77	261	10.26	3,832
20....	5.23	58	6.46	55	5.96	86	4.16	55	5.83	278	9.75	3,332
21....	5.23	58	6.28	54	5.84	83	4.14	55	5.77	261	9.31	2,901
22....	5.23	58	6.12	53	5.93	82	4.14	55	5.68	237	8.77	2,372
23....	5.24	59	6.00	53	6.51	80	4.25	57	5.66	232	8.39	2,002
24....	5.34	60	5.96	52	6.15	78	4.24	57	5.64	228	8.26	1,876
25....	5.21	59	5.51	51	5.99	76	4.24	57	5.63	225	8.34	1,954
26....	5.10	57	4.73	50	4.47	76	4.35	59	5.70	242	8.54	2,148
27....	5.13	53	4.54	49	4.42	76	4.49	64	5.81	242	8.79	2,391
28....	5.13*a*	51	4.51	49	4.60	75	4.63	76	5.97	322	8.78	2,381
29....	5.13*a*	50	4.47	49	4.51	75	4.55	69	5.88	293	8.89	2,489
30....	5.13*a*	50	.....	.....	4.63	74	4.53	67	5.91	302	8.37	1,983
31....	5.13*a*	51	.....	.....	4.45	70	.....	.....	5.92	306	.....	.....

a Gauge heights interpolated.
b Ice conditions January 1 to April 17.

DAILY GAUGE HEIGHT AND DISCHARGE of Bow river near Lake Louise, for 1916.—*Concluded.*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	8.14	1,760	7.23	991	7.36	1,085	5.51	200	5.23	152	7.14	97
2	8.13	1,750	7.33	1,063	7.36	1,085	5.46	191	5.30	163	6.79	95
3	8.32	1,934	7.53	1,216	7.45	1,154	5.38	177	5.21	150	6.71	91
4	8.24	1,857	7.24	998	7.38	1,100	5.30	163	5.24	154	6.38	87
5	8.11	1,731	7.09	893	7.31	1,048	5.28	160	5.22	151	6.24	83
6	7.68	1,339	7.04	859	7.06	872	5.28	160	5.19	146	6.08	80
7	7.80	1,440	7.07	879	6.78	693	5.20	148	5.00	118	6.20	79
8	7.36	1,085	7.18	956	6.78	693	5.20	148	5.11	134	6.14	78
9	8.77	2,372	7.39	1,108	6.66	622	5.16	142	5.13	138	5.97	76
10	8.76	2,362	7.21	977	6.43	503	5.15	140	4.91	105	6.01	75
11	8.68	2,284	7.03	852	6.30	446	5.13	138	4.69	81	5.98	73
12	8.89	2,489	6.93	786	6.26	430	5.12	136	4.66*b*	83	5.78	71
13	9.19	2,783	6.93	786	6.17	395	5.11	134	4.80	86	5.67	69
14	8.59	2,196	7.02	845	6.05	350	5.15	140	4.90	88	5.54	69
15	8.08	1,702	7.12	914	5.96	319	5.20	148	5.15	89	5.49	68
16	8.11	1,731	7.04	859	5.90	299	5.71	245	5.78	91	5.53	67
17	8.43	2,041	6.92	779	5.88	293	6.14	383	6.30	92	5.44	67
18	8.36	1,973	6.85	736	5.88	293	5.91	302	6.80	94	5.60	66
19	8.02	1,643	6.63	605	5.88	293	5.82	275	6.95	96	5.51	66
20	7.72	1,373	6.44	508	5.84	281	5.70	242	7.22	99	5.48	66
21	7.43	1,138	6.28	438	5.79	266	5.63	225	7.22	100	5.46	65
22	7.26	1,013	6.33	459	5.79	266	5.55	208	7.22	101	5.48	65
23	7.05	866	6.59	583	5.84	281	5.47	193	7.24	101	5.48	64
24	6.84	729	6.84	729	5.84	281	5.41	182	7.33	101	5.48	64
25	7.09	893	6.90	766	5.93	309	5.39	178	7.33	101	5.43	64
26	7.19	963	6.91	772	5.81	272	5.40	180	7.38	101	5.13	63
27	7.25	1,006	6.96	805	5.59	216	5.37	175	7.31	100	5.24*a*	60
28	7.16	942	6.95	798	5.59	216	5.26	157	7.30	98	5.36*a*	57
29	6.97	812	6.98	818	5.54	206	5.23	152	7.30	97	5.47	57
30	6.94	792	7.01	838	5.59	216	5.22	152	7.17	97	5.68	60
31	7.08	886	7.57	1,249	.....	.....	5.24	154	.....	.....	5.42*b*	62

a Gauge height interpolated.
b Ice conditions November 12 to December 31.

MONTHLY DISCHARGE of Bow river near Lake Louise, for 1916

(Drainage area 159 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	79	50	63	0.396	0.46	3,874
February	58	49	53	0.333	0.36	3,049
March	92	49	70	0.440	0.51	4,304
April	76	55	61	0.384	0.43	3,630
May	322	89	218	1.371	1.58	13,404
June	3,832	284	1,403	8.824	9.84	83,324
July	2,783	729	1,545	9.717	11.20	94,998
August	1,249	438	834	5.245	6.05	51,281
September	1,154	206	492	3.094	3.45	29,276
October	383	134	185	1.164	1.34	11,375
November	163	81	110	0.692	0.77	6,545
December	97	57	71	0.447	0.52	4,366
The year	.....	.....	.....	.....	36.51	309,426

MEAN MONTHLY DISCHARGE in Second-feet of Bow river near Lake Louise

MONTH	1910-11	1911-12	1912-13	1913-14	1914-15	1915-16	1916-17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	108	145	199	194	162	185	165	10,171
November	.....	72a	95	100	99	106	110	102	6,067
December	.....	.....	88	77	60	93	71	78	4,791
January	97	49	44	62	50	63	.....	61	3,353
February	58	63	42	52	46	53	.....	52	2,941
March	58	42	44	55	45	70	.....	52	3,218
April	99	55	81	59	144	61	.....	83	4,950
May	317	325	389	373	355	218	.....	330	20,258
June	1,403	1,015	1,368	1,013	796	1,403	.....	1,166	69,373
July	1,309	1,022	1,090	1,725	1,107	1,545	.....	1,300	79,712
August	897	1,147	1,005	906	1,223	834	.....	1,002	61,615
September	485	351	559	405	483	492	.....	462	27,524
Total in Acre-feet	286,140	251,507	299,924	305,584	279,690	309,126	.....	.....	293,973

a 1-9.

PIPESTONE RIVER NEAR LAKE LOUISE

Location.—On the SW. ¼ Sec. 27, Tp. 28, Rge. 16, W. 5th Mer., one-half mile east of Lake Louise station, at the confluence of the Bow and Pipestone rivers.

Records available.—September 1, 1911, to October 31, 1911; January 1, 1912, to December 31, 1916.

Gauge.—Chain: Elevation of zero maintained at 4,985.04 feet since establishment.

Bench-mark.—Permanent iron bench-mark on left bank, elevation 4,993.73 feet above mean sea-level (Canadian Pacific Railway datum).

Channel.—Small boulders and gravel. High water may shift boulders.

Discharge measurements.—Made from cable or by wading.

Floods.—Stream was in flood during June, 1916. Maximum gauge height 7.73 feet; stream did not overflow banks.

Observer.—E. Braund.

DISCHARGE MEASUREMENTS of Pipestone river near Lake Louise, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 19	J. M. Paul	43.0	17.8	1.31	4.43	23
Feb. 15	H. C. Ritchie	35.0	22.5	1.00	4.20	22
Mar. 1	do	37.0	24.0	1.02	4.20	24
Mar. 14	do	35.0	16.0	1.59	5.20	26
Mar. 28	do	37.0	31.0	1.10	4.03	33
April 18	do	43.0	30.0	0.84	3.93	25
May 9	do	58.0	57.0	1.79	4.53	102
May 30	do	65.0	72.0	2.62	4.85	190
June 27	do	82.0	230.0	6.71	6.84	1,545
June 27	do	82.0	230.0	6.71	6.84	1,545*x*
July 6	do	78.0	159.0	4.56	5.94	723
July 27	do	77.0	139.0	4.19	5.79	581
Aug. 15	do	75.0	127.0	3.74	5.54	476
Sept. 4	do	77.0	136.0	4.02	5.75	547
Oct. 2	do	63.0	58.0	1.88	4.76	109
Oct. 26	do	63.0	61.0	1.92	4.71	117
Dec. 7	do	46.0	34.0	1.03	5.00	34
Dec. 30	W. K. Broughton	25.0	11.8	3.06	4.86	36

x Slope measurement.

DAILY GAUGE HEIGHT AND DISCHARGE of Pipestone river near Lake Louise, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.52*b*	24	4.36	24	4.24	24	3.92	25	4.21	51	4.85	187
2	4.46	24	4.34	24	4.25	24	3.89	23	4.26	58	4.84	184
3	4.47	24	4.27	24	4.28	24	3.93	26	4.51	98	4.78	166
4	4.36	24	4.25	23	4.26	24	3.88	23	4.62	123	4.76	160
5	4.35	24	4.23	23	4.25	24	3.91	25	4.85	187	4.97	226
6	4.37	24	4.23	24	4.25	24	3.84	20	4.91	206	5.01	241
7	4.37	23	4.23	24	4.24	24	3.84	20	4.89	199	4.96	223
8	4.38	23	4.23	24	4.23	24	3.94	27	4.75	158	5.00	237
9	4.38	23	4.26	24	4.24	24	3.93	26	4.51	98	5.15	296
10	4.38	23	4.26	23	4.28	25	3.93	26	4.44	85	5.13	287
11	4.39	23	4.20	23	4.84	25	3.89	23	4.36	72	5.06	260
12	4.39	23	4.21*a*	22	5.34	26	3.87	22	4.31	64	5.14	291
13	4.40	23	4.23*a*	22	4.93	26	3.93	26	4.33	68	5.26	342
14	4.40	23	4.22*a*	22	5.20	26	3.93	26	4.39	76	5.38	397
15	4.40	23	4.22	22	5.05	26	3.94	27	4.34	69	5.67	549
16	4.39	23	4.22	24	4.84	27	3.88	23	4.55	107	6.17	919
17	4.41	23	4.73	28	4.32	28	3.84	20	4.58	114	6.63	1,350
18	4.41	23	4.69	28	5.26	28	3.90	24	4.78	166	6.91	1,613
19	4.42	23	4.44	25	4.13	29	3.92	25	4.83	181	7.73	2,384
20	4.42	23	4.43	25	4.18	30	3.89	23	4.87	193	7.26	1,942
21	4.40	23	4.39	24	4.05	30	3.84	20	4.83	181	6.93	1,632
22	4.40	23	4.42	24	4.16	30	3.75	16	4.83	181	6.47	1,200
23	4.37	23	4.34	24	3.98	31	3.91	25	4.67	136	6.24	984
24	4.39	23	4.29	24	4.00	32	3.96	28	4.64	128	6.17	919
25	4.38	23	4.24	24	3.92	32	4.04	35	4.61	120	6.30	1,040
26	4.38	23	4.30	24	3.97	32	4.05	36	4.64	128	6.39	1,125
27	4.39	23	4.32	24	3.92	33	4.10	40	4.83	181	6.68	1,397
28	4.43	23	4.35	24	3.92	33	4.26	58	4.94	216	6.58	1,303
29	4.46	24	4.26	24	3.93	32	4.14	44	4.82	178	6.77	1,482
30	4.46	25	.....	.....	3.98	30	4.03	34	4.84	184	6.48	1,209
31	4.42	25	.....	.....	3.93*b*	26	.....	.....	4.87	193	.....	.....

a Gauge height interpolated.
b Ice conditions, January 1 to March 31.

DAILY GAUGE HEIGHT AND DISCHARGE of Pipestone river near Lake Louise, for 1916—*Concluded*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	6.25	993	5.68	528	5.50	420	4.77	123	4.66	93	5.64	42
2	6.32	1,059	5.68	530	5.46	400	4.76	120	4.68	98	5.60	41
3	6.39	1,125	5.77	582	5.73	538	4.73	111	4.57	73	5.43	40
4	6.22	965	5.53	454	5.75	548*s*	4.50	58	4.65	91	5.29	38
5	6.37	1,106	5.47	425	5.65	492	4.69	101	4.62	84	5.24	36
6	5.88	681*s*	5.46	421	5.46	391	4.70	103	4.56	71	5.03	35
7	6.00	766	5.49	438	5.34	333	4.63	86	4.47	53	5.08	34
8	6.43	1,062	5.57	481	5.31	319	4.67	96	4.58	75	5.04	34
9	6.60	1,312	5.69	550	5.28	306	4.59	77	4.62	84	4.92	34
10	6.51	1,224	5.54	468	5.20	272	4.62	84	4.55	68	4.83	34
11	6.40	1,120	5.43	413	5.15	252	4.66	93	4.44	48	4.79	33
12	6.57	1,272	5.38	392	5.15	252	4.64	89	4.51*b*	48	4.79	33
13	6.86	1,540	5.38	394	5.08	224	4.64	89	4.55	47	4.74	32
14	6.13	858	5.47	437	5.05	212	4.68	98	4.76	46	4.48	31
15	5.84	640	5.50	454	5.03	205	4.68	98	5.14	46	4.44	30
16	6.05	790	5.47	436	5.01	198	4.89	158	5.32	45	4.29	31
17	6.21	923	5.37	388	4.99	191	5.18	264	5.48	45	4.78	32
18	6.08	807	5.37	384	4.97	184	4.90	161	5.67	45	4.83	34
19	5.87	648	5.26	333	4.97	184	4.97	184	5.57	46	4.79	36
20	5.76	580	5.18	297	4.94	174	4.88	155	5.57	46	4.72	36
21	5.58	475	5.09	260	4.91	164	4.80	131	5.57	46	4.78	36
22	5.51	440	5.16	286	4.89	158	4.77	123	5.63	45	4.83	36
23	5.43	398	5.39	384	4.89	158	4.74	114	5.65	45	4.77	36
24	5.38	372	5.47	420	4.86	149	4.70	103	5.66	45	4.83	36
25	5.58	468	5.48	423	4.96	181	4.70	103	5.66	44	4.83	36
26	5.70	534	5.39	380	4.87	152	4.70	103	5.69	44	4.83	36
27	5.78	580	5.39	378	4.82	137	4.70	103	5.71	44	4.93	36
28	5.71	540	5.36	362	4.87	152	4.57	73	5.67	44	4.82*a*	36
29	5.50	428	5.35	356	4.77	123	4.66	93	5.67	44	4.72	36
30	5.48	420	5.37	363	4.72	109	4.66	93	5.59	43	4.85	36
31	5.57	468	5.76	561	.....	.....	4.67	96	.....	.....	4.93*b*	36

a Gauge height interpolated.
b Ice conditions from November 12 to December 31.
s Shifting conditions from July 6 to September 4.

MONTHLY DISCHARGE of Pipestone river near Lake Louise, for 1916

(Drainage area 136 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	25	23	23	0.169	0.19	1,414
February	28	22	24	0.176	0.19	1,380
March	33	24	28	0.206	0.24	1,722
April	58	16	27	0.198	0.22	1,607
May	216	51	135	0.993	1.14	8,301
June	2,384	160	818	6.010	6.70	48,674
July	1,540	372	793	5.830	6.72	48,760
August	582	260	419	3.080	3.55	25,763
September	548	109	253	1.860	2.08	15,055
October	264	58	112	0.824	0.95	6,887
November	98	43	57	0.420	0.47	3,392
December	42	30	35	0.257	0.30	2,152
The year	.....	.....	.....	.....	22.75	165,107

MEAN MONTHLY DISCHARGE in Second-feet of Pipestone river near Lake Louise

MONTH	1910-11	1911-12	1912-13	1913-14	1914-15	1915-16	1916-17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	90	101	127	151	118	112	116	7,160
November	.....	.....	145	63	60	71	57	79	4,707
December	.....	.....	96	52	36	33	35	50	3,095
January	.....	31 a	43	39	42	23	.....	37	2,260
February	.....	26	38	28	27	24	.....	29	1,614
March	.....	14	29	29	34	28	.....	27	1,646
April	.....	13	55	37	94	27	.....	45	2,805
May	.....	265	245	291	241	135	.....	235	14,471
June	.....	558	748	683	475	818	.....	656	39,053
July	.....	468	533	640	577	793	.....	602	37,029
August	.....	511	457	293	484	419	.....	433	26,608
September	200	225	292	170	189	253	.....	222	13,176
Total in Acre-feet	11,901	132,754	168,372	148,680	146,359	166,186	.....	.....	153,624

a 24-31

LOUISE CREEK NEAR LAKE LOUISE

Location.—On the NE. ¼ Sec. 20, Tp. 28, Rge. 16, W. 5th Mer., at the Chateau Lake Louise, five hundred feet below the lake.

Records available.—July 11, 1913, to December 31, 1916.

Gauge.—Vertical staff. Zero elevation maintained at 93.72 feet since establishment to June 9, 1915. Zero elevation maintained at 90.63 feet from June 9, 1915, to December 31, 1916.

Bench-mark.—Spikes in tree on left bank about fifteen feet below gauge; assumed elevation 100.00 feet.

Channel.—Permanent.

Discharge measurements.—Made by wading.

Diversions.—The penstock of the Lake Louise power plant takes water from the lake and this quantity must be added to the discharge of Louise creek to obtain the total run-off from the lake.

Observer.—J. Talerico.

DISCHARGE MEASUREMENTS of Louise creek near Lake Louise, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 20	J. M. Paul	.....	.....	.....	3.80	1.40*e*
Mar. 28	H. C. Ritchie	.....	.....	.....	3.49	0.33*e*
May 9	do	.....	.....	.....	4.00	1.00*e*
May 30	do	17.7	12.14	0.61	4.08	7.30
June 23	do	20.0	19.20	3.31	4.69	64.00
July 6	do	20.0	19.20	3.06	4.65	59.00
July 27	do	22.0	21.25	3.50	4.72	74.00
Aug. 15	do	22.0	25.25	3.22	4.81	81.00
Sept. 5	do	22.0	22.90	2.88	4.74	66.00
Oct. 2	do	14.7	7.12	1.55	4.16	11.00
Oct. 26	do	16.0	8.40	1.66	4.22	14.00
Nov. 17	do	14.0	5.25	0.89	4.16	4.70
Dec. 29	W. K. Broughton	11.0	2.85	0 38	3.93	1.07

e Discharge estimated by personal observation of the District Engineer, and was composed of seepage, through the dam, which was being constructed to raise the level of Lake Louise.

DAILY GAUGE HEIGHT AND DISCHARGE of Louise creek near Lake Louise, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.70*b*	0.70	3.63	0.48	3.64	0.51	3.65	0.54	3.78	1.26	4.10	8.2
2	3.70	0.70	3.62	0.45	3.64	0.51	3.65	0.54	3.80	1.40	4.10	8.2
3	3.70	0.70	3.55	0.36	3.66	0.58	3.66	0.58	3.83	1.82	4.09	7.9
4	3.70	0.70	3.55	0.36	3.69	0.67	3.66*b*	0.58	3.89	2.70	4.10	8.2
5	3.70	0.70	3.52	0.35	3.71	0.77	3.66	0.58	3.90	2.80	4.10	8.2
6	3.70	0.70	3.52	0.35	3.72	0.84	3.66	0.58	3.91	3.00	4.10	8.2
7	3.70	0.70	3.52	0.35	3.74	0.98	3.66	0.58	3.92	3.20	4.09	7.9
8	3.70	0.70	3.52	0.35	3.75	1.05	3.66	0.58	3.97	4.30	4.18	11.9
9	3.70	0.70	3.52	0.35	3.64	0.51	3.66	0.58	4.00	5.00	4.30	19.4
10	3.70	0.70	3.52	0.35	3.64	0.51	3.66	0.58	4.00	5.00	4.22	14.1
11	3.70	0.70	3.52	0.35	3.63	0.48	3.66	0.58	4.08	7.60	4.23	14.8
12	3.67	0.61	3.51	0.34	3.63	0.48	3.66	0.58	4.07	7.20	4.18	11.9
13	3.67	0.61	3.51	0.34	3.62	0.45	3.66	0.58	4.04	6.30	4.18	11.9
14	3.67	0.61	3.51	0.34	3.62	0.45	3.66	0.58	3.97	4.30	4.24	15.4
15	3.66	0.58	3.50	0.34	3.54	0.36	3.66	0.58	3.95	3.90	4.30	19.4
16	3.66	0.58	3.50	0.34	3.54	0.36	3.66	0.58	3.94	3.70	4.55	46.0
17	3.66	0.58	3.50	0.34	3.53	0.36	3.65	0.54	3.94	3.70	4.60	52.0
18	3.66	0.58	3.50	0.34	3.53	0.36	3.65	0.54	3.94	3.70	4.65	59.0
19	3.66	0.58	3.50	0.34	3.53	0.36	3.66	0.58	3.93	3.40	4.66*a*	60.0
20	3.80	1.40	3.50	0.34	3.53	0.36	3.66	0.58	3.91	3.00	4.67*a*	62.0
21	3.80	1.40	3.49	0.34	3.53	0.36	3.66	0.58	3.91	3.00	4.68*a*	63.0
22	3.80	1.40	3.49	0.34	3.55	0.36	3.66	0.58	3.91	3.00	4.69*a*	65.0
23	3.80	1.40	3.48	0.33	3.54	0.36	3.66	0.58	3.94	3.70	4.69	65.0
24	3.80	1.40	3.48	0.33	3.54	0.36	3.66	0.58	3.98	4.60	4.70	66.0
25	3.70	0.70	3.46	0.32	3.53	0.36	3.66	0.58	3.98	4.60	4.70	66.0
26	3.70	0.70	3.46	0.32	3.53	0.36	3.66	0.58	4.00	5.00	4.72	69.0
27	3.70	0.70	3.45	0.32	3.53	0.36	3.66	0.58	4.00	5.00	4.72	69.0
28	3.70	0.70	3.44	0.31	3.53	0.36	3.66	0.58	4.00	5.00	4.72	69.0
29	3.70	0.70	3.43	0.30	3.53	0.36	3.66	0.58	4.08	7.60	4.72	69.0
30	3.70	0.70	.....	.....	3.53	0.36	3.67	0.61	4.08	7.60	4.71	67.0
31	3.70	0.70	.....	.....	3.53	0.36	.....	.....	4.10	8.20	.....	.....

a Gauge height interpolated.
b Ice conditions January 1 to April 4.

DAILY GAUGE HEIGHT AND DISCHARGE of Louise creek near Lake Louise, for 1916.—*Concluded.*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.71	67	4.79	79	4.84	86.0	4.16	11.0	4.18	11.9	4.03	3.00
2	4.71	67	4.81	81	4.84	86.0	4.16	11.0	4.17	11.4	4.03	3.00
3	4.71	67	4.83	84	4.82	83.0	4.16	11.0	4.17	11.4	4.03	2.90
4	4.72	69	4.85	87	4.78	77.0	3.94	3.7	4.17	11.4	4.03	2.70
5	4.68	63	4.78	77	4.76	74.0	3.92	3.2	4.17	11.4	4.03	2.50
6	4.68	63	4.80	80	4.72	69.0	3.92	3.2	4.16	11.0	4.01	2.40
7	4.68	63	4.83	84	4.67	62.0	3.92	3.2	4.15	10.5	4.01	2.30
8	4.70	66	4.81	81	4.68	63.0	3.96	4.1	4.15	10.5	3.99	2.30
9	4.72	69	4.77	76	4.66	60.0	3.97	4.3	4.14	10.0	3.99	2.20
10	4.72	69	4.78	77	4.64	58.0	3.97	4.3	4.14	10.0	3.99	2.20
11	4.88	91	4.88	91	4.57	48.0	3.99	4.8	4.12*b*	8.7	3.99	2.10
12	4.88	91	4.90	94	4.57	48.0	3.99	4.8	4.12	8.0	4.00	2.10
13	4.88	91	4.93	98	4.54	44.0	4.02	5.6	4.12	7.3	4.01	2.10
14	4.82	83	4.82	83	4.66	60.0	4.04	6.3	4.12	6.7	4.01	2.00
15	4.82	83	4.80	80	4.46	35.0	4.06	6.9	4.12	5.7	4.01	2.00
16	4.88	91	4.76	74	4.46	35.0	4.06	6.9	4.12	5.0	4.01	2.00
17	4.88	91	4.74	72	4.46	35.0	4.26	16.8	4.12	4.7	4.00	1.90
18	4.92	97	4.66	60	4.45	34.0	4.30	19.4	4.12	4.6	4.00	1.90
19	4.80	80	4.60	52	4.46	35.0	4.06	6.9	4.11	4.5	4.00	1.80
20	4.79	79	4.47	36	4.46	35.0	4.06	6.9	4.11	4.4	4.00	1.70
21	4.80	80	4.46	35	4.40	28.0	4.18	11.9	4.07	4.3	3.99	1.70
22	4.69	65	4.51	40	4.43	31.0	4.23	14.8	4.07	4.0	3.99	1.60
23	4.66	60	4.68	63	4.37	25.0	4.24	15.4	4.07	3.9	3.99	1.50
24	4.68	63	4.73	70	4.39	27.0	4.23	14.8	4.07	3.9	3.99	1.40
25	4.68	63	4.76	74	4.39	27.0	4.23	14.8	4.07	3.7	3.99	1.30
26	4.68	63	4.78	77	4.36	25.0	4.24	15.4	4.07	3.6	3.99	1.20
27	4.71	67	4.78	77	4.30	19.4	4.24	15.4	4.05	3.3	3.99	1.20
28	4.71	67	4.78	77	4.26	16.8	4.23	14.8	4.05	3.1	3.99	1.10
29	4.71	67	4.78	77	4.18	11.9	4.20	12.8	4.05	3.1	3.99	1.04
30	4.75	73	4.77	76	4.16	11.0	4.20	12.8	4.03	3.0	3.98	1.02
31	4.79	79	4.86	88	.....	.....	4.18	11.9	.....	.....	3.93*b*	0.86

b Ice conditions November 11 to December 31.

MONTHLY DISCHARGE of Louise creek near Lake Louise, for 1916

(Drainage area 10 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	1.40	0.58	0.77	0.077	0.09	47
February	0.48	0.30	0.35	0.035	0.04	20
March	1.05	0.36	0.48	0.048	0.06	30
April	0.61	0.54	0.58	0.058	0.06	35
May	8.20	1.26	4.40	0.440	0.50	271
June	69.00	7.90	37.00	3.700	4.13	2,202
July	91.00	60.00	74.00	7.400	8.53	4,550
August	98.00	35.00	74.00	7.400	8.53	4,550
September	86.00	11.00	45.00	4.500	5.02	2,678
October	19.40	3.20	9.60	0.960	1.11	590
November	11.90	3.00	6.80	0.680	0.76	405
December	3.00	0.86	1.90	0.190	0.22	117
The year	.....	.....	.....	.....	29.05	15,495

FORTYMILE CREEK AT BANFF

Location.—On the SW. ¼ Sec. 2, Tp. 26, Rge. 12, W. 5th Mer., near the Canadian Pacific railway station at Banff and one mile from the mouth of the stream.

Records available.—August 1, 1912, to December 31, 1916.

Gauge.—Vertical staff; elevation of zero maintained at 91.43 feet since establishment.

Bench-mark.—Permanent iron bench-mark on right bank; assumed elevation 100.00 feet.

Channel.—Clay and gravel.

Discharge measurements.—Made from bridge and by wading.

Observer.—S. Neilson.

DISCHARGE MEASUREMENTS of Fortymile creek near Banff, for 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq.-ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 13	H. C. Ritchie	24.0	26.0	0.63	3.43	16.4
Jan. 25	J. M. Paul	25.0	32.5	0.67	2.61	22.0
Feb. 5	H. C. Ritchie	23.0	28.5	0.54	2.81	15.4
Feb. 19	do	26.0	40.0	0.76	2.60	31.0
Mar. 3	do	25.0	31.0	0.45	2.64	14.0
Mar. 15	do	25.0	16.7	1.24	2.42	20.8
Mar. 27	do	26.0	16.2	1.16	2.39	18.7
April 14	do	28.0	18.6	1.17	2.50	22.0
May 11	do	30.5	25.6	2.14	2.73	55.0
June 2	do	40.5	44.3	1.85	3.10	82.0
June 22	do	32.0	189.0	2.75	7.07	519.0
July 4	do	32.0	161.0	3.06	6.37	492.0
July 28	do	32.0	81.4	2.08	4.04	168.0
Aug. 19	do	32.0	71.4	1.76	3.48	126.0
Sept. 2	do	30.0	60.7	1.45	3.25	88.0
Oct. 5	do	29.0	30.8	1.79	2.99	55.0
Oct. 25	do	28.0	32.7	1.38	2.93	45.0
Nov. 13	do	23.0	22.2	0.72	2.60	16.0
Dec. 5	do	25.0	27.0	0.95	2.75	26.0
Dec. 27	W. K. Broughton	23.0	18.1	0.73	3.32	13.2

DAILY GAUGE HEIGHT AND DISCHARGE of Fortymile creek near Banff, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.72[b]	16.8	2.38	18.3	2.50	14.5	2.46[b]	27	2.51	32	3.00	74
2	2.87	16.7	2.17	17.3	2.52	14.2	2.47	29	2.57	37	3.15	88
3	2.88	16.4	2.06	16.4	2.64	14.0	2.45	27	2.67	45	3.12	85
4	3.16	16.2	2.63	15.8	2.62	14.8	2.45	27	2.69	47	3.15	88
5	3.17	16.0	2.80	15.4	2.62	16.0	2.44	26	2.85	62	3.22	94
6	3.15	15.8	2.78	15.6	2.50	16.7	2.48	29	2.97	71	3.22	94
7	3.13	15.6	2.57	16.0	2.44	17.0	2.49	30	2.97	71	3.25	96
8	3.11	15.7	2.56	16.7	2.44	17.0	2.50	31	2.95	70	3.20	92
9	3.17	15.9	2.66	17.5	2.44	17.2	2.51	32	2.87	63	3.22	94
10	3.25	16.1	2.71	18.8	2.46	17.7	2.51	32	2.82	59	3.25	96
11	3.28	16.2	2.65	20.0	2.48	19.0	2.50	31	2.80	57	3.32	103
12	3.33	16.3	2.56	22.0	2.50	19.8	2.49	30	2.73	51	3.40	110
13	3.47	16.4	2.55	24.0	2.44	20.0	2.49	30	2.71	49	3.45	114
14	3.51	17.3	2.46	27.0	2.52	21.0	2.50	31	2.68	46	3.62	131
15	3.53	18.6	2.52	29.0	2.49	21.0	2.50	31	2.67	45	4.25	196
16	3.63	19.9	2.55	30.0	2.49	21.0	2.50	31	2.65	44	5.40	335
17	3.83	21.0	2.82	32.0	2.47	20.0	2.49	30	2.65	44	6.60	506
18	3.28	23.0	2.70	32.0	2.53	20.0	2.47	29	2.72	50	7.10	584
19	2.73	24.0	2.54	31.0	2.51	21.0	2.46	28	2.73	51	7.90	712
20	2.51	25.0	2.50	29.0	2.49	21.0	2.45	27	2.74	52	7.50	648
21	2.27	25.0	2.47	26.0	2.49	21.0	2.45	27	2.87	63	7.10	584
22	2.12	25.0	2.43	24.0	2.45	20.0	2.45	27	2.91	66	6.10	431
23	2.04	24.0	2.41	22.0	2.45	20.0	2.45	27	2.93	68	6.00	416
24	2.00	23.0	2.40	20.0	2.45	19.5	2.45	27	2.96	70	5.90	402
25	2.07	22.0	2.38	18.2	2.43	19.0	2.46	28	2.98	72	6.20	446
26	2.04	21.0	2.41	17.0	2.43	19.0	2.51	32	3.00	74	6.70	521
27	2.63	21.0	2.39	16.0	2.43	18.7	2.52	33	2.88	64	6.80	536
28	2.06	20.0	2.41	15.3	2.41	18.9	2.53	33	2.96	70	6.70	521
29	2.64	20.0	2.40	14.7	2.40	20.0	2.52	33	3.00	74	6.60	506
30	2.78	19.7	.....	.....	2.40	23.0	2.51	32	3.00	74	6.40	476
31	2.77	19.2	.....	.....	2.40	25.0	.....	.....	2.99	73	.....	.....

b Ice conditions, January 1 to April 1.

DAILY GAUGE HEIGHT AND DISCHARGE of Fortymile creek near Banff, for 1916—*Concluded*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	6.00	416	3.77	146	3.26	89	3.09	65	2.89	40	2.79	30.0
2	6.30	461	3.82	151	3.30	95	3.08	63	2.90	41	2.80	31.0
3	6.50	491	3.97	166	3.30	95	3.08	63	2.91	42	2.82	33.0
4	6.31	462	3.72	141	3.30	95	3.07	62	2.90	41	2.75	27.0
5	6.01	418	3.62	131	3.35	104	3.07	62	2.89	40	2.75	27.0
6	5.41	336	3.52	121	3.40	112	3.07	62	2.89	40	2.65*b*	26.0
7	6.01	418	3.52	121	3.30	95	3.06	61	2.84	35	2.64	25.0
8	6.11	432	3.62	131	3.25	88	3.06	61	2.82	33	2.55	25.0
9	6.01	418	3.92	161	3.25	88	3.06	61	2.82	33	2.54	24.0
10	6.41	478	3.92	161	3.25	88	3.06	61	2.81	32	2.55	23.0
11	6.11	432	3.67	136	3.25	88	3.05	60	2.81	32	2.52	22.0
12	6.21	448	3.62	131	3.25	88	3.03	57	2.66	20	2.52	22.0
13	5.81	389	3.62	131	3.25	88	3.01	54	2.65	20	2.56	22.0
14	5.51	349	3.52	121	3.25	88	3.01	54	2.62	17	2.57	22.0
15	5.26	317	3.47	116	3.20	80	2.96	48	2.62	17	2.59	22.0
16	5.41	336	3.42	112	3.20	80	2.91	42	2.70	23	2.62	21.0
17	5.51	349	3.42	112	3.20	80	2.91	42	2.75	27	2.66	21.0
18	5.66	369	3.62	131	3.15	73	3.01	54	2.78	29	2.61	19.6
19	4.76	254	3.52	121	3.15	73	3.01	54	2.80	31	2.64	18.7
20	4.11	180	3.50	130	3.15	73	3.01	54	2.80	31	2.65	17.5
21	4.21	191	3.45	121	3.19	79	3.01	54	2.82	33	3.30	16.0
22	4.11	180	3.40	112	3.19	79	3.01	54	2.86	37	3.35	14.8
23	4.11	180	3.35	104	3.15	73	3.01	54	2.85	36	2.79	14.2
24	4.21	191	3.40	112	3.15	73	2.99	52	2.68	22	2.82	13.8
25	4.11	180	3.40	112	3.12	69	2.96	48	2.75	27	3.29	13.5
26	4.11	180	3.40	112	3.10	66	2.95	47	2.78	29	3.31	13.4
27	4.16	186	3.41	114	3.10	66	2.95	47	2.82	33	3.32	13.2
28	4.22	192	3.41	114	3.10	66	2.94	46	2.81	32	3.42	13.9
29	4.12	181	3.31	97	3.10	66	2.92	43	2.80	31	3.47	15.7
30	3.97	166	3.31	97	3.18	77	2.91	42	2.82	33	3.47	17.4
31	3.72	141	3.31	97	.....	.....	2.91	42	.....	.....	3.47*b*	18.3

b Ice conditions, December 6 to December 31.

MONTHLY DISCHARGE of Fortymile creek near Banff, for 1916

(Drainage area 62 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	25	15.6	19.3	0.311	0.36	1,187
February	32	14.7	21.0	0.339	0.37	1,208
March	25	14.0	18.9	0.305	0.35	1,162
April	33	26.0	30.0	0.484	0.54	1,785
May	74	32.0	59.0	0.952	1.10	3,628
June	712	74.0	306.0	4.935	5.51	18,208
July	491	141.0	314.0	5.065	5.84	19,307
August	166	97.0	125.0	2.016	2.32	7,686
September	112	66.0	82.0	1.323	1.48	4,879
October	65	42.0	54.0	0.871	1.00	3,320
November	42	17.0	31.0	0.500	0.56	1,845
December	33	13.2	21.0	0.339	0.39	1,291
The year	.....	.....	.....	.....	19.82	65,506

MEAN MONTHLY DISCHARGE in Second-feet of Fortymile creek near Banff

MONTH	1911-12	1912-13	1913-14	1914-15	1915-16	1916-17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	69	65	64.0	61.0	54.0	63	3,850
November	.....	45	44	43.0	45.0	31.0	42	2,477
December	.....	26	33	24.0	18.6	21.0	25	1,504
January	.....	29	23	27.0	19.3	.....	25	1,508
February	.....	25	22	20.0	21.0	.....	22	1,239
March	.....	21	28	15.5	18.9	.....	21	1,276
April	.....	37	29	33.0	30.0	.....	32	1,921
May	.....	94	122	77.0	59.0	.....	88	5,418
June	.....	366	306	184.0	306.0	.....	290	17,286
July	.....	165	201	227.0	314.0	.....	227	13,942
August	145	120	78	115.0	125.0	.....	117	7,172
September	108	98	53	72.0	82.0	.....	83	4,910
Total in acre-feet	15,342	66,075	60,767	54,665	66,623	.....	.....	62,503

BOW RIVER AT BANFF

Location.—On the SE. ¼ Sec. 35, Tp. 25, Rge. 12, W. 5th Mer., at the highway bridge at Banff.

Records available.—May 25, 1909, to November 11, 1909; April 26, 1910, to December 31, 1915.

Gauge.—Chain gauge on bridge; elevation of zero maintained at 92.04 feet during 1909-12; elevation of zero maintained at 93.21 feet during 1913; elevation of zero maintained at 93.06 feet during 1914; elevation of zero maintained at 87.23 feet during 1915-16.

Bench-mark.—Permanent iron bench-mark on the right bank; assumed elevation 100.00 feet. This bench-mark is at datum 99.68 feet referred to the old bench-mark now destroyed.

Channel.—Permanent; gravel and boulders.

Discharge measurements.—Made from bridge.

Observer.—N. B. Sanson.

Accuracy.—The gauge at this station was read once daily, at the same hour, to one-hundredth of a foot and the records are fairly accurate.

The daily discharges are computed from an open water curve, which runs through eight out of eleven discharge measurement points, the remaining three plotting very close to the curve. The discharges are well within the limit of error.

During the winter the daily discharge is determined from a study of daily gauge heights, temperatures and discharge measurements and is a reasonably close estimate.

DISCHARGE MEASUREMENTS of Bow river at Banff, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 17	J. M. Paul	59.0	155	2.32	6.59	359
Feb. 17	H. C. Ritchie	50.0	157	2.32	6.76	365
Mar. 2	do	52.5	124	1.99	6.01	246
Mar. 17	do	55.0	97	2.68	6.10	261
Mar. 31	do	58.0	131	2.28	6.04	299
April 17	do	98.0	161	2.15	6.15	347
May 12	do	195.0	326	2.49	7.07	812
June 10	do	338.0	691	2.73	8.06	1,882
June 19	do	372.0	1,763	5.68	10.90	10,021
June 20	do	380.0	1,940	5.56	11.45	10,786*x*
June 21	do	378.0	1,903	5.59	11.32	10,640
June 24	do	362.0	1,396	4.37	9.90	6,100*x*
July 29	do	340.0	1,007	4.10	8.63	4,129
Aug. 14	do	340.0	965	2.83	8.44	2,728
Sept. 7	do	339.5	901	2.68	8.32	2,417
Oct. 9	do	314.0	487	1.58	7.08	772
Oct. 24	do	324.0	528	1.64	7.18	864
Nov. 16	do	128.0	257	1.70	6.53	438
Dec. 9	do	117.0	205	1.78	6.39	365
Dec. 26	W. K. Broughton	108.0	113	1.79	6.51	345

x Slope measurement.

Daily Gauge Height and Discharge of Bow river at Banff, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	6.23*b*	357	7.27	358	6.02	252	6.09	317	6.51	474	7.62	1,294
2	6.24*a*	354	7.28	359	6.03	246	6.08*a*	314	6.70	565	7.62	1,294
3	6.26	353	7.28	360	6.10	246	6.08	314	6.94	701	7.59	1,259
4	6.30	352	7.33	360	6.10	249	6.06	308	7.12	830	7.71*a*	1,402
5	6.33	350	7.32	363	6.10*a*	252	6.06	308	7.44	1,100	7.83	1,552
6	6.41	348	7.38*a*	365	6.10	252	6.06	308	7.58	1,248	7.82	1,538
7	6.46	348	7.44	368	6.09	251	6.10	320	7.50*a*	1,160	7.80	1,510
8	6.49	347	7.38	370	6.07	250	6.14	334	7.43	1,090	7.84	1,566
9	6.48*a*	347	7.40	373	6.10	253	6.16*a*	341	7.30	970	8.02	1,846
10	6.46	348	7.37	374	6.11	258	6.19	352	7.24	922	8.05	1,900
11	6.51	348	7.36	375	6.17	262	6.17	344	7.12	830	8.01	1,828
12	6.54	349	7.37	375	6.14*a*	262	6.12	327	7.07	792	8.02	1,846
13	6.55	351	7.35*a*	375	6.12	259	6.13	330	6.73	580	8.07	1,936
14	6.54	353	7.33	375	6.05	255	6.18	348	6.88*a*	663	8.33	2,433
15	6.56	356	7.16*a*	372	6.10	258	6.21	358	7.04	770	8.76	3,436
16	6.58*a*	358	6.99*a*	369	6.10	259	6.18*a*	348	7.07	792	9.44	5,323
17	6.59	359	6.81	365	6.10	261	6.16	341	7.15	852	10.09	7,270
18	6.62	359	6.43	332	6.15	266	6.13*a*	330	7.27	946	10.48	8,440
19	6.63	358	6.33	319	6.13*a*	267	6.10	320	7.41	1,070	10.84	9,520
20	6.70	357	6.26*a*	312	6.11	270	6.12	327	7.49	1,150	11.31	10,930
21	6.75	357	6.18	307	6.12	274	6.14	334	7.46*a*	1,120	11.20	10,600
22	6.76	355	6.16	303	6.12	280	6.12	327	7.44	1,100	10.68	9,040
23	6.78*a*	354	6.16	300	6.07*b*	290	6.12*a*	327	7.41	1,070	10.14	7,420
24	6.80	353	6.13	297	6.05	305	6.11	324	7.39	1,051	9.93	6,790
25	6.96	352	6.12	293	6.07	311	6.14	334	7.35	1,015	10.00	7,000
26	7.04	352	6.12	290	6.06*a*	308	6.23	366	7.33	997	10.09	7,270
27	7.07	352	6.10*a*	284	6.06	308	6.47	457	7.42	1,080	10.12	7,360
28	7.09	353	6.09	277	6.03	299	6.56	497	7.62	1,294	10.55	8,650
29	7.17	353	6.12	262	6.02	296	6.56	497	7.64	1,318	10.50	8,500
30	7.21*a*	355	.....	.....	6.00	290	6.54*a*	488	7.62	1,294	9.85	6,550
31	7.25	357	.....	.....	6.05	305	.....	.....	7.60	1,270	.....	.....

a Gauge height interpolated.
b Ice conditions from January 1 to March 23.

DAILY GAUGE HEIGHT AND DISCHARGE of Bow river at Banff, for 1916.—*Concluded.*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1....	9.70	6,100	8.70	3,280	8.51	2,823	7.38	1,042	7.01	748	6.60	460
2....	9.78	6,340	8.71	3,306	8.50	2,800	7.32	988	6.99	734	6.60	460
3....	9.90	6,700	8.79	3,514	8.59	3,007	7.28	954	6.94	701	6.64*a*	480
4....	9.92	6,760	8.67	3,205	8.63	3,105	7.23	914	7.05	778	6.69	500
5....	9.62	5,860	8.55	2,915	8.61	3,055	7.20	890	6.96*a*	714	6.56	450
6....	9.38	5,147	8.52*a*	2,846	8.48	2,756	7.16	860	6.87	657	6.40	380
7....	9.40	5,205	8.49	2,778	8.27	2,310	7.14	845	6.90	675	6.32	340
8....	9.92	6,760	8.56	2,938	8.20	2,170	7.10*a*	815	6.92	688	6.42	380
9....	10.32	7,960	8.76	3,436	8.23	2,230	7.05	778	6.92	688	6.40	365
10....	10.45	8,350	8.74	3,384	8.06	1,918	7.08	800	6.79	610	6.42*a*	380
11....	10.28	7,840	8.54	2,892	7.97	1,762	7.05	778	6.61	520	6.45	387
12....	10.05	7,150	8.44	2,668	8.03	1,864	7.03	762	6.23	366	6.50	390
13....	10.25	7,750	8.44*a*	2,668	7.94	1,714	7.02	755	6.12	327	6.42	390
14....	10.03	7,090	8.43	2,646	7.90	1,650	7.02	755	6.32	397	6.43	385
15....	9.55	5,650	8.51	2,823	7.81	1,524	7.02*a*	755	6.49*b*	420	6.46	385
16....	9.45	5,352	8.46	2,712	7.77	1,474	7.03	762	6.53	438	6.47	385
17....	9.80	6,400	8.35	2,475	7.74*a*	1,438	7.42	1,080	6.60	460	6.46*a*	385
18....	9.92	6,760	8.46	2,712	7.72	1,414	7.53	1,193	6.58	450	6.45	383
19....	9.56	5,680	8.29	2,350	7.69	1,378	7.42	1,080	6.61*a*	465	6.55	380
20....	9.32	4,973	8.18*a*	2,134	7.64	1,318	7.36	1,024	6.64	480	6.53	377
21....	9.07	4,278	8.06	1,918	7.60	1,270	7.30	970	6.64	480	6.53	378
22....	8.90	3,810	8.04	1,882	7.59	1,259	7.24*a*	922	6.72	520	6.71	380
23....	8.77*a*	3,462	8.30	2,370	7.57	1,237	7.17	868	6.63	475	6.76	380
24....	8.64	3,130	8.33	2,433	7.58*a*	1,248	7.17	868	6.47	410	6.69*a*	375
25....	8.65	3,155	8.34	2,454	7.59	1,259	7.13	838	6.61	470	6.62	359
26....	8.76	3,436	8.34	2,454	7.54	1,204	7.14	845	6.64*a*	480	6.54	345
27....	8.75	3,410	8.34*a*	2,454	7.49	1,150	7.13	838	6.67	500	6.46	336
28....	8.76	3,436	8.33	2,433	7.43	1,090	7.01	748	6.67	500	6.44	330
29....	8.71*a*	3,306	8.33	2,433	7.36	1,024	7.00*a*	740	6.63	480	6.37	329
30....	8.65*a*	3,155	8.32	2,412	7.42	1,080	7.00	740	6.64	480	6.42	329
31....	8.60	3,030	8.37	2,517	.....	.....	7.03	762	.....	.....	6.44*ab*	330

a Gauge height interpolated.
b Ice conditions November 15 to December 31.

MONTHLY DISCHARGE of Bow river at Banff, for 1916

(Drainage area 884 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	359	347	353	0.399	0.46	21,705
February	375	262	339	0.383	0.41	19,500
March	311	246	271	0.307	0.35	16,663
April	497	308	351	0.397	0.44	20,886
May	1,318	474	971	1.100	1.27	59,704
June	10,930	1,259	4,910	5.550	6.19	292,165
July	8,350	3,030	5,401	6.110	7.04	332,094
August	3,514	1,882	2,692	3.050	3.52	165,525
September	3,105	1,080	1,784	2.020	2.25	106,155
October	1,193	740	870	0.984	1.13	53,494
November	778	327	537	0.607	0.68	31,954
December	500	329	384	0.434	0.50	23,611
The year	.....	.....	.....	.....	24.24	1,143,456

MEAN MONTHLY DISCHARGE in Second-feet of Bow river at Banff

MONTH	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	834	1,204	680	1,017	1,013	1,219	870	870	963	59,236
Nov.....	.....	*b* 466	*d* 819	415	584	603	581	548	537	545	32,410
Dec.....	.....	.....	*e* 451	380	429	399	359	445	384	399	24,554
January	.....	.....	347	291	321	350	287	353	.....	325	19,969
February	.....	.....	327	266	280	315	277	339	.....	301	16,900
March..	.....	.....	302	224	256	285	266	271	.....	267	16,437
April....	.....	*c* 2,262	367	295	412	399	553	351	.....	396	23,570
May....	*a* 2,596	3,090	1,240	1,485	1,395	1,846	1,589	971	.....	1,659	102,033
June....	6,204	5,346	6,251	3,430	5,624	4,922	3,234	4,910	.....	4,990	296,935
July....	5,787	4,723	4,438	3,566	3,552	4,861	4,394	5,401	.....	4,590	282,241
August.	2,473	2,778	2,565	3,530	3,025	2,602	3,557	2,692	.....	2,903	178,483
Sept. ...	1,578	1,257	1,504	1,847	2,028	1,484	1,570	1,784	.....	1,631	97,085
Total in Acre-ft.	1,007,051	1,128,047	1,173,262	995,952	1,144,703	1,156,549	1,086,325	1,147,861	.....	.....	1,149,853

a 25–31.
b 1–11.
c 26–30.
d 1–16.
e 28 days.

SPRAY RIVER NEAR SPRAY LAKES

Location.—On the SE. ¼ Sec. 31, Tp. 22, Rge. 10, W. 5th Mer., one-half mile above Spray creek.

Records available.—July 23 to October 27, 1914 (discharge measurements only). June 9 to October 17, 1915, and July 17 to October 31, 1916.

Gauge.—Chain gauge on right bank; elevation of zero 88.52 feet maintained since establishment.

Bench-mark.—On tree; assumed elevation 100.00 feet.

Channel.—Permanent.

Discharge measurements.—Made by wading. Cable station installed above gauge September 15, 1915.

Observer.—Geo. Pickering.

Remarks.—Insufficient discharge measurements were made in 1914 and 1915 to accurately determine the daily discharge.

DISCHARGE MEASUREMENTS of Spray river near Spray lakes, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
July 17.....	H. C. Ritchie.....	83	318	5.85	7.60	1,858
Sept. 28.....	do	80	160	2.02	5.93	323

Daily Gauge Height and Discharge of Spray river near Spray lakes, for 1916

Day	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	6.66*a*	753	6.48*a*	621	5.84*a*	290
2	.....	.....	6.68	768	6.49	627	5.80	275
3	.....	.....	6.64*a*	737	6.58*a*	692	5.82*a*	282
4	.....	.....	6.61	714	6.67	761	5.84	290
5	.....	.....	6.54*a*	663	6.64*a*	737	5.81*a*	279
6	.....	.....	6.47	614	6.62	722	5.78	268
7	.....	.....	6.52*a*	648	6.57*a*	684	5.76*a*	261
8	.....	.....	6.57	684	6.52	648	5.75	258
9	.....	.....	6.55*a*	670	6.49*a*	627	5.76*a*	261
10	.....	.....	6.53	656	6.46	608	5.78	268
11	.....	.....	6.50*a*	634	6.38*a*	556	5.76*a*	261
12	.....	.....	6.46	608	6.31	514	5.75	258
13	.....	.....	6.44*a*	594	6.30*a*	508	5.74*a*	254
14	.....	.....	6.41	575	6.29	502	5.72	247
15	.....	.....	6.40*a*	568	6.30*a*	508	5.71*a*	244
16	.....	.....	6.40	568	6.31	514	5.70	240
17	7.60	1,861	6.42*a*	581	6.22*a*	464	5.70*a*	240
18	7.55*a*	1,793	6.45	601	6.14	422	5.70	240
19	7.50	1,725	6.46*a*	608	6.16*a*	433	5.69*a*	236
20	7.52*a*	1,752	6.47	614	6.18	443	5.68	233
21	7.55	1,793	6.51*a*	641	6.10*a*	402	5.68*a*	233
22	7.47*a*	1,684	6.55	670	6.03	369	5.67	230
23	7.39	1,575	6.60*a*	706	6.02*a*	364	5.65*a*	223
24	7.34*a*	1,507	6.64	737	6.01	360	5.63	215
25	7.29	1,440	6.62*a*	722	5.99*a*	351	5.62*a*	212
26	7.26*a*	1,399	6.59	699	5.97	342	5.60	205
27	7.24	1,373	6.56*a*	677	5.94*a*	329	5.60*a*	205
28	7.01*a*	1,089	6.54	663	5.90	312	5.60	205
29	6.78	854	6.49	627	5.88*a*	305	5.60	205
30	6.70*a*	784	6.48*a*	621	5.87	301	5.60	205
31	6.63	729	6.48	621	.....	.....	5.58	199

a Gauge height interpolated.

Monthly Discharge of Spray river near Spray lakes, for 1916

(Drainage area 193 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
July (17-31)	1,861	729	1,424	7.38	4.12	42,357
August	768	568	653	3.38	3.90	40,151
September	761	301	501	2.60	2.90	29,812
October	290	199	243	1.26	1.45	14,941
The period	.....	.....	.....	.....	12.37	127,261

SPRAY CREEK AT SPRAY LAKES

Location.—On the SW. ¼ Sec. 32, Tp. 22, Rge. 10, W. 5th Mer.

Records available.—July 23 to October 27, 1914 (discharge measurements only), June 9 to October 17, 1915, and July 16 to October 31, 1916.

Gauge.—Vertical staff at right bank; assumed elevation 95.02 feet, maintained since establishment.

Bench-mark.—Three spikes together on tree; assumed elevation 100.00 feet.

Channel.—Permanent.

Discharge measurements.—Made by wading.

Observer.—Geo. Pickering.

DISCHARGE MEASUREMENTS of Spray creek at Spray lakes, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec*	*Feet*	*Sec.-ft.*
July 17	H. C. Ritchie	39	62.2	4.77	1.94	311
Sept. 27	do	35	33.0	2.95	0.71	97
Sept 28	do	35	33.3	2.85	0.70	95

DAILY GAUGE HEIGHT AND DISCHARGE of Spray creek at Spray lakes, for 1916

Day	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			1.22*a*	168	1.16*a*	159	0.64*a*	89
2			1.15	157	1.09	148	0.62	87
3			1.14*a*	155	1.34*a*	190	0.64*a*	89
4			1.14	155	1.59	239	0.65	90
5			1.13*a*	154	1.54*a*	229	0.63*a*	88
6			1.12	152	1.49	219	0.61	86
7			1.25*a*	174	1.48*a*	217	0.59*a*	84
8			1.38	197	1.46	213	0.57	82
9			1.36*a*	193	1.32*a*	186	0.58*a*	83
10			1.35	192	1.19	163	0.58	83
11			1.32*a*	186	1.12*a*	152	0.56*a*	81
12			1.30	182	1.04	140	0.55	80
13			1.28*a*	179	1.03*a*	138	0.55*a*	80
14			1.26	175	1.02	137	0.55	80
15			1.26*a*	175	1.00*a*	134	0.54*a*	79
16	1.85	294	1.25	174	0.99	133	0.53	78
17	1.94	312	1.22*a*	168	0.94*a*	126	0.54*a*	79
18	1.97*a*	319	1.18	162	0.89	119	0.54	79
19	2.00	325	1.22*a*	168	0.87*a*	116	0.54*a*	79
20	1.95*a*	314	1.25	174	0.85	114	0.53	78
21	1.90	304	1.22*a*	168	0.83*a*	111	0.52*a*	77
22	1.88*a*	300	1.19	163	0.81	108	0.52	77
23	1.85	294	1.26*a*	175	0.80*a*	107	0.50*a*	75
24	1.84*a*	291	1.34	190	0.79	106	0.48	73
25	1.83	289	1.36*a*	193	0.76*a*	102	0.50*a*	75
26	1.72*a*	266	1.39	199	0.74	100	0.51	76
27	1.60	241	1.38*a*	197	0.71*a*	96	0.52*a*	77
28	1.45*a*	211	1.36	193	0.68	93	0.53	78
29	1.30	182	1.27	177	0.66*a*	91	0.53	78
30	1.29*a*	180	1.26*a*	175	0.65	90	0.48	73
31	1.28	179	1.24	172			0.48	73

a Gauge height interpolated.

MONTHLY DISCHARGE of Spray creek at Spray lakes, for 1916

(Drainage area 35 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
July 16-31	325	179	269	7.69	4.57	8,535
August	199	152	176	5.03	5.80	10,822
September	239	90	143	4.09	4.56	8,509
October	90	73	80	2.29	2.64	4,919
The period					17.57	32,785

SPRAY RIVER NEAR BANFF

Location.—On the SW. ¼ Sec. 25, Tp. 25, Rge. 12, W. 5th Mer., at the highway bridge near the Canadian Pacific Railway Banff Springs Hotel, near the confluence of the stream with the Bow river.

Records available.—July 15, 1910, to December 31, 1916.

Gauge.—Chain on left bank; elevation of zero maintained at 93.29 feet during 1910-11. Elevation of zero maintained at 88.71 feet during 1912-16.

Bench-mark.—Permanent iron bench-mark on the left bank; assumed elevation 100.00 feet.

Channel.—Permanent; gravel; large boulders at left bank near pier.

Discharge measurements.—Made from a bridge.

Observer.—N. B. Sanson.

DISCHARGE MEASUREMENTS of Spray river near Banff, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 4	H. C. Ritchie	32.5	69	2.56	5.35	176
Jan. 22	J. M. Paul	26.5	86	2.26	5.31	194
Feb. 18	H. C. Ritchie	24.5	63	2.34	5.02	158
Mar. 4	do	24.5	62	2.24	5.02	138
Mar. 16	do	24.5	62	2.63	5.02	164
Mar. 27	do	32.5	61	2.76	4.66	168
April 15	do	37.5	63	2.86	4.72	180
May 11	do	87.5	94	3.75	5.38	352
June 2	do	114.0	130	4.01	5.59	520
June 20	do	121.5	510	9.09	9.32	4,644
July 5	do	102.5	345	8.62	8.15	2,971
July 26	do	75.0	220	6.87	6.69	1,514
Aug. 12	do	70.5	174	6.25	6.25	1,084
Sept. 1	do	67.5	171	6.06	6.02	1,035
Oct. 5	do	58.5	121	4.28	5.13	516
Oct. 23	do	58.0	106	3.55	4.94	375
Nov. 14	do	45.5	83	2.92	4.55	243
Dec. 7	do	47.5	69	2.56	4.30	177
Dec. 27	W. K. Broughton	32.5	57	3.03	4.28	170

DAILY GAUGE HEIGHT AND DISCHARGE of Spray river near Banff, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.88*b*	178	5.25	175	4.91	138	4.62	160	4.97	257	5.63	555
2	5.10*a*	181	5.31	175	4.90	137	4.62*a*	160	4.99	264	5.61	541
3	5.30	181	5.39	177	4.90	137	4.61	157	5.14	317	5.62	548
4	5.11	180	5.48	179	5.09	138	4.61	157	5.24	356	5.74*a*	628
5	5.37	181	5.19	172	5.11*a*	144	4.60	155	5.41	429	5.87	726
6	5.54	187	5.18*a*	169	5.13	146	4.61	157	5.51	486	5.87*a*	726
7	5.48	188	5.16	170	5.09	146	4.63	163	5.53*a*	496	5.88	734
8	5.44	187	5.39	174	5.15	149	4.63	163	5.55	508	5.94	784
9	5.37*a*	185	5.29	172	5.15	153	4.65*a*	167	5.49	475	6.03	862
10	5.30	180	5.27	169	5.16	155	4.67	173	5.46	452	6.14	963
11	5.29	177	5.22	167	5.14	158	4.67	173	5.38	415	6.13*a*	953
12	5.35	175	5.25	167	5.15*a*	160	4.65	167	5.32	389	6.12	944
13	5.52	175	5.22*a*	166	5.15	162	4.66	170	5.30	380	6.16	982
14	5.53	176	5.20	165	5.20	163	4.77	199	5.28*a*	372	6.35	1,165
15	5.64	177	5.15*a*	163	5.16	164	4.70	180	5.26	364	6.92	1,782
16	5.70*a*	179	5.10*a*	161	5.05	164	4.70*a*	180	5.24	356	7.34	2,244
17	5.74	184	5.06	158	5.01	163	4.69	178	5.33	393	7.93	2,893
18	5.65	190	5.02	158	5.21	167	4.69*a*	178	5.40	424	8.53	3,553
19	5.56	196	5.00	156	5.09*a*	167	4.69	178	5.52	491	9.20	4,290
20	5.56	198	5.00*a*	155	4.97	164	4.69	178	5.56	513	9.37	4,477
21	5.50	198	5.01	155	4.96	164	4.69	178	5.58*a*	524	9.20	4,290
22	5.31	194	5.00	154	4.94	164	4.59	153	5.61	541	8.73	3,773
23	5.28*a*	192	5.03	153	5.04	164	4.62*a*	160	5.58	524	8.33	3,333
24	5.24	188	4.97	151	4.73	165	4.66	170	5.54	502	8.24	3,234
25	5.30	182	4.99	148	4.69	166	4.70	180	5.49	475	8.32*a*	3,322
26	5.42	180	5.00	146	4.67*a*	167	4.76	196	5.46	452	8.40	3,410
27	5.27	182	5.02*a*	145	4.65	168	4.98	261	5.49	475	8.38	3,388
28	5.32	183	5.03	145	4.71*b*	169	4.96	254	5.54*a*	502	8.38	3,388
29	5.27	180	4.95	142	4.64	165	4.93	245	5.59	529	8.42	3,432
30	5.28*a*	178	.....	.....	4.62	160	4.95*a*	251	5.63	555	7.92	2,882
31	5.30	177	.....	.....	4.61	158	.....	...	5.62	548	....	...

a Gauge height interpolated.
b Ice conditions, January 1 to March 28.

DAILY GAUGE HEIGHT AND DISCHARGE of Spray river near Banff, for 1916—*Concluded*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	7.50	2,420	6.47	1,289	6.02	1,035*s*	5.28*a*	530	4.81	326	4.50	228
2	8.00	2,970	6.40	1,215	5.95	973	5.23	505	4.83	333	4.58	251
3	8.30	3,300	6.46	1,278	6.28*a*	1,256	5.23	505	4.76	308	4.56*a*	245
4	8.18	3,168	6.25	1,068	6.60	1,565	5.19	486	4.83	333	4.55*b*	240
5	7.82	2,772	6.35	1,165	6.57	1,535	5.13	459	4.80*a*	322	4.53	220
6	7.62	2,552	6.22*a*	1,039	6.44	1,408	5.14	463	4.76	308	4.43	190
7	7.58	2,508	6.10	925	6.25	1,228	5.13*a*	459	4.70	288	4.30	177
8	8.05	3,025	6.19	1,010	6.13	1,121	5.12*a*	454	4.73	298	4.40	175
9	8.35	3,355	6.47	1,289	6.14	1,129	5.10	445	4.74	302	4.40	175
10	8.40	3,410	6.45	1,267	6.05*a*	1,052	5.06	427	4.65	273	4.45*a*	170
11	8.22	3,212	6.30	1,115	5.96	980	5.04	418	4.62	263	4.50	180
12	7.92	2,882	6.25	1,068*s*	5.91	943	5.01	404	4.51*a*	231	4.29	160
13	7.81*a*	2,761	6.20*a*	1,040	5.84	890	5.02	409	4.40	200	4.43	175
14	7.70	2,640	6.14	990	5.81	868	4.99	396	4.53	237	4.32	160
15	7.38	2,288	6.14	1,005	5.74	818	4.98*a*	392	4.71	291	4.61	180
16	7.25	2,145	6.11	980	5.68	776	4.97	388	4.74	302	4.49	165
17	7.70	2,640	6.08	963	5.64*a*	748	5.07	432	4.76	308	4.50*a*	165
18	7.73*a*	2,673	6.22	1,110	5.61	727	5.04	418	4.76	308	4.52	165
19	7.76	2,706	6.11	1,005	5.55	687	5.01	404	4.63*a*	266	4.45	160
20	7.38	2,288	6.06*a*	970	5.48	643	4.98	392	4.50	228	4.21	150
21	7.23	2,123	6.02	945	5.48	643	4.97	388	4.62	263	4.25	155
22	7.10	1,980	6.20	1,120	5.47	637	4.96*a*	384	4.61	260	4.36	160
23	6.96*a*	1,826	6.45	1,385	5.43	613	4.94	376	4.46	217	4.40	165
24	6.82	1,672	6.50	1,450	5.40*a*	595	4.90	360	4.44	211	4.40*a*	165
25	6.65	1,485	6.42	1,380	5.38	584	4.88	352	4.61	260	4.41	165
26	6.60	1,430	6.35	1,320	5.37	578	4.92	368	4.61*a*	260	4.26	165
27	6.50	1,320	6.30*a*	1,275	5.36	573	4.91	364	4.62	263	4.30	170
28	6.50	1,320	6.24	1,220	5.33	556	4.85	341	4.56	245	4.33	175
29	6.50*a*	1,320	6.18	1,160	5.32	551	4.85*a*	341	4.54	240	4.35	175
30	6.45*a*	1,267	6.10	1,100	5.32	551	4.85	341	4.54	240	4.52	165
31	6.40	1,215	6.06	1,070	.....	.....	4.84	337	.....	.....	4.56*ab*	165

a Gauge height interpolated.
b Ice conditions, December 4-31.
s Shifting conditions, August 12 to September 1.

MONTHLY DISCHARGE of Spray river near Banff, for 1916

(Drainage area 299 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	198	175	184	0.616	0.71	11,314
February	179	142	162	0.542	0.58	9,318
March	169	137	157	0.525	0.61	9,654
April	261	153	181	0.605	0.68	10,770
May	555	257	444	1.490	1.72	27,300
June	4,477	541	2,160	7.220	8.06	128,530
July	3,410	1,215	2,344	7.840	9.04	144,126
August	1,450	925	1,136	3.800	4.38	69.850
September	1,565	551	875	2.920	3.26	52,066
October	530	337	411	1.370	1.58	25,271
November	333	200	272	0.910	1.02	16,185
December	251	150	179	0.599	0.69	11,006
The year	.....	.....	.....	.....	32.33	515,390

MEAN MONTHLY DISCHARGE in Second-feet of Spray river near Banff

MONTH	1909-10	1910-11	1911-12	1912-13	1913-14	1914-15	1915-16	1916-17	Mean in Sec.-ft.	Mean in Acre-ft.
October		443	315	428	447	533	364	411	420	25,834
November		*b*	226	272	298	333	257	272	276	16,439
December		237*c*	209	237	225	183	193	179	204	12,561
January		199	150	202	196	182	184		186	11,405
February		146	141	151	167	179	162		158	8,855
March		143	108	146	167	172	157		149	9,152
April		156	134	191	180	276	181		186	11,084
May		389	517	535	755	675	444		552	33,972
June		2,011	1,405	2,144	1,942	1,196	2,160		1,810	107,679
July	1,153*a*	1,523	1,398	1,041	1,736	1,477	2,344		1,586	97,550
August	784	829	907	908	772	929	1,136		895	55,032
September	490	544	664	703	491	507	875		611	36,334
Total in acre-feet	116,231	398,687	374,229	420,353	446,766	402.746	512,471			425,897

a 15-31
b No observations.
c 4-31.

CASCADE RIVER AT BANKHEAD

Location.—On the SE. ¼ Sec. 19, Tp. 26, Rge. 11, W. 5th Mer., at the Bankhead Mines.
Records available.—August 16, 1911, to December 31, 1916.
Gauge.—Vertical staff; elevation of zero maintained at 93.49 feet since establishment.
Bench-mark.—Permanent iron bench-mark on right bank; assumed elevation 100.00 feet.
Channel.—Is being encroached upon by the waste from the mine.
Discharge measurements.—Made from traffic bridge, three miles below gauge.
Artificial control.—This station is two and one-half miles below the reservoir of the Calgary Power Company at Lake Minnewanka, near Bankhead Mines water supply, and the flow of the stream is controlled by the gates.
Observer.—W. E. Cowan.

DISCHARGE MEASUREMENTS of Cascade river at Bankhead, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 15	H. C. Ritchie				3.67	370*e*
Feb. 18	do	85.0	91.0	3.83	1.92	348
Mar. 4	do	84.0	116.0	4.03	2.14	466
Mar. 16	do	87.0	111.6	3.81	2.30	425
Mar. 30	do	79.0	82.0	2.94	1.88	241
April 20	do	79.0	75.0	2.77	1.71	208
May 10	do	26.0	26.5	1.76	0.86	47
May 29	do	56.0	56.9	0.96	0.92	54
July 31	do	81.0	210.0	2.23	3.91	467
Aug. 17	do	81.0	232.0	2.82	4.15	654
Sept. 8	do	82.0	238.0	2.08	3.56	704
Oct. 7	do	79.0	158.0	1.09	3.06	172
Oct. 28	do	83.0	103.0	3.18	3.63	327
Nov. 20	do	83.5	139.0	4.02	4.18	558
Dec. 8	do				4.17	550*e*
Dec. 28	W. K. Broughton	91.0	143.8	4.17	7.83	600

e Estimated discharge: calculated from area and velocity.

Daily Gauge Height and Discharge of Cascade river at Bankhead, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.59*b*	168	2.44	310	1.90	425	1.77	216	1.16	83	0.94	56
2	2.35	167	2.79	310	2.20	470	1.78	219	1.16	83	0.95	58
3	2.05	165	2.69	320	2.22	473	1.76	213	1.11	76	0.95	58
4	2.06	160	2.96	340	2.16	466	1.73	205	1.06	70	0.95	58
5	2.01	152	2.81	343	2.14	460	2.50	526	1.03	67	0.97	60
6	1.99	145	2.40	335	2.18	456	2.39	470	1.03	67	0.97	60
7	1.98	150	2.06	313	2.16	460	2.31	430	1.04	68	1.02	65
8	1.97	164	2.19	320	2.06	461	2.28	416	1.04	68	1.02	65
9	2.12	210	2.15	325	2.04	455	2.17	365	1.04	68	1.02	65
10	2.74	256	2.10	325	2.01	438	2.09	331	0.86	48	1.01	64
11	2.80	295	2.05	320	1.96	426	2.04	311	0.86	48	1.01	64
12	3.18	330	1.95	320	1.91	417	2.01	299	0.86	48	1.01	64
13	3.33	351	1.89	340	2.06	409	1.95	276	0.86	48	1.02	65
14	3.63	369	1.82	362	2.01	410	1.92	265	0.86	48	1.08	73
15	3.67	370	1.82	365	2.16*b*	418	1.87	248	0.88	50	1.09	74
16	3.65	370	2.03	360	2.29	425	1.86	245	0.89	51	2.46	108
17	3.07	336	1.99	353	2.26	406	1.78	219	0.89	51	3.62	326
18	2.87	312	1.92	348	2.36	455	1.75	210	0.86	48	3.97	501
19	2.27	295	1.88	343	2.32	435	1.71	199	0.86	48	4.59	878
20	2.21	283	1.84	339	2.27	411	1.72	202	0.86	48	4.67	927
21	2.14	280	2.06	365	2.22	387	1.71	199	0.86	48	4.69	939
22	2.51	281	1.99	376	2.17	365	1.65	182	0.86	48	4.66	921
23	2.69	285	2.01	376	2.12	344	1.56	159	0.86	48	4.66	921
24	2.72	291	1.98	371	2.08	327	1.64	180	0.88	50	4.60	884
25	2.87	300	1.86	364	2.03	307	1.41	125	0.87	49	4.60	884
26	3.10	310	1.92	362	1.97	284	1.56	159	0.91	53	4.59	878
27	3.14	324	1.79	395	1.94	273	1.58	164	0.91	53	4.62	896
28	3.28	336	1.99	390	1.92	265	1.21	91	0.93	55	4.62	896
29	3.28	341	1.95	385	1.87	248	1.21	91	0.94	56	4.62	896
30	3.21	338	.....	.....	1.85	242	1.21	91	0.94	56	4.62	896
31	2.90	320	.....	.....	1.80	225	.....	.....	0.94	56	.....	.....

b Ice conditions from January 1 to March 15.

DAILY GAUGE HEIGHT AND DISCHARGE of Cascade river at Bankhead, for 1916—*Concluded*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.60	884	3.95	488	3.53	551	2.70	170	3.46	269	4.07	531
2	4.60	884	3.96	500	3.53	570	2.73	168	3.46	269	4.02	530
3	4.64	908	3.97	508	3.46	543	2.73	162	3.46	269	3.97	501
4	4.62	896	4.00	528	3.47	570	2.80	164	3.56	303	4.39	756
5	4.60	884	4.02	544	3.47	589	2.92	175	3.67	347	4.33	719
6	4.58	872	4.11	604	3.44	588	2.97	170	3.67	347	4.31	707
7	4.58	872	4.12	610	3.52	660	3.22	204*s*	3.67	347	4.23	658
8	4.58	872	4.12	612	3.52	678	3.22	204	3.77	394	4.17	622
9	4.58	872	4.12	616	3.22	492	3.22	204	3.77	394	4.15	609
10	4.58	872	4.13	624	3.17	458	3.22	204	3.76	389	4.07	561
11	4.58	872	4.13	626	3.20	466	3.17	194	3.72	370	4.49	817
12	4.58	872	4.13	628	3.22	470	3.17	194	3.97	501	4.44	786
13	4.57	866	4.13	631	3.27	490	3.13	186	4.05	548	4.41*b*	760
14	4.54	847	4.11	622	3.28	488	3.13	186	4.00	518	4.25	650
15	4.50	823	4.11	626	3.33	511	3.13	186	3.97	501	4.17	600
16	4.50	823	4.11	628	3.35	516	3.21	202	3.92	472	4.09	540
17	4.50	823	4.11	629	3.34	502	3.25	211	3.87	445	4.03	500
18	4.50	823	4.13	656	3.31	477	3.45	266	3.87	445	3.79	403
19	4.50	823	4.13	670	3.30*a*	463	3.52	288	4.14	603	3.77	390
20	4.34	725	4.13	684	3.00	317	3.50	281	4.18	628	4.31	640
21	4.34	725	4.09	683	2.99	304	3.73	374	4.19	634	4.38	640
22	4.34	725	4.09	698	2.83	246	3.72	370	4.19	634	4.93	630
23	4.02	530	4.09	720	2.74	218	3.71	365	4.17	622	5.04	630
24	4.02	530	4.01	688	2.67	200	3.68	351	4.12	591	5.28	630
25	4.06	555	3.81	588	2.66	192	3.67	347	3.98	507	6.23	620
26	4.06	555	3.73	558	2.99	273	3.67	347	4.28	689	6.68	620
27	4.04	542	3.69	552	3.12	310	3.67	347	4.27	683	6.38	610
28	3.96	495	3.67	558	3.07	282	3.64	334	4.25	670	7.58	600
29	3.85	434	3.62	550	2.71	184	3.56	303	4.18	628	4.69	230
30	3.86	440	3.58	542	2.70	176	3.46	269	4.18	628	4.09	230
31	3.93	478*s*	3.55	544			3.46	269			3.88*b*	230

a Gauge height interpolated.
b Ice conditions, December 13-31.
s Shifting conditions, July 31 to October 7.

MONTHLY DISCHARGE of Cascade river at Bankhead, for 1916

(Drainage area 244 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	370	145	273	1.120	1.29	16,786
February	395	310	347	1.420	1.53	19,960
March	473	225	388	1.590	1.83	23,857
April	526	91	244	1.000	1.12	14,519
May	83	48	57	0.238	0.27	3,505
June	939	56	423	1.730	1.93	25,170
July	908	434	746	3.060	3.53	45,870
August	720	488	604	2.480	2.86	37,139
September	678	176	426	1.750	1.95	25,349
October	374	162	248	1.020	1.18	15,249
November	689	269	488	2.000	2.23	29,038
December	817	230	580	2.377	2.74	35,663
The year					22.46	292,105

MEAN MONTHLY DISCHARGE in Second-feet of Cascade river at Bankhead

MONTH	1910-11	1911-12	1912-13	1913-14	1914-15	1915-16	1916-17	Mean in Sec.-ft.	Mean in Acre-feet
October	.....	226	278	200	206	202	248	227	13,937
November	.....	166*b*	290	377	224	238	488	323	19,248
December	.....	.....	314	637	158	166	580	371	22,810
January	.....	149*c*	166	217	159	273	.....	204	12,528
February	.....	85	140	92	266	347	.....	186	10,500
March	.....	102*d*	184	98	379	388	.....	262	16,130
April	.....	67	342	90	216	244	.....	192	11,413
May	.....	301	259	122	57	57	.....	159	9,794
June	.....	648	878	890	843	423	.....	736	43,824
July	.....	338	417	625	1,444	746	.....	714	43,899
August	624 *a*	788	583	172	764	604	.....	582	35,798
September	411	289	350	74	235	426	.....	298	17,706
Total in acre-feet	44,259	181,575	253,798	217,638	299,834	248,944	.....	.....	257,587

a 16-31.
b 1-6.
c 1-4 and 8-31.
d 1-21 and 27-31.

BOW RIVER NEAR KANANASKIS

Location.—On the NW. ¼ Sec. 32, Tp. 24, Rge. 8, W. 5th Mer., at the Canadian Pacific railway bridge, one mile above the Kananaskis falls (upper) dam of the Calgary Power company.

Records available.—March 10, 1912, to December 31, 1916. Records obtained at Morley, ten miles down stream, from May 25, 1910, to November 30, 1911.

Gauge.—Chain; elevation of zero maintained at 90.84 feet since establishment.

Bench-mark.—On side of east pier; assumed elevation 100.00 feet.

Channel.—Permanent, solid rock, fairly uniform.

Discharge measurements.—Made from the bridge; at very low stages by wading.

Observer.—The Calgary Power company.

Accuracy.—Gauge heights were recorded daily to hundredths of a foot and give a fair average of each day's water level.

The discharges are taken from a curve plotted from a series of open water measurements, which curve passes through ten points out of fourteen; the remaining four points plot very close to this curve and the daily discharges during open water may be considered to be fairly accurate.

The winter discharges are arrived at from a graph based on stream measurements, temperatures and daily gauge heights. The results in January, February and March are fairly reasonable estimates; those in December are not quite as satisfactory, as no measurement could be made during that month owing to the condition of this stream and the insecurity of the ice.

DISCHARGE MEASUREMENTS of Bow river near Kananaskis, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 4	H. C. Ritchie	240	385	1.97	4.28	759
Jan. 27	J. M. Paul	346	372	2.18	4.38	810
Feb. 26	H. C. Ritchie	351	384	2.67	2.08	1,028
Mar. 21	do	361	405	2.84	2.15	1,154
April 12	do	350	373	2.60	2.07	970
May 2	do	347	379	2.73	2.04	1,034
May 23	do	381	527	3.54	2.51	1,865
June 15	do	408	811	5.81	3.26	4,709
June 22	A. B. Cook	440	1,950	10.27	5.96	20,040
June 26	do	427	1,423	8.70	4.76	12,388
July 24	H. C. Ritchie	415	1,056	6.51	3.74	6,876
Aug. 10	do	411	963	6.58	3.60	6,344
Aug. 30	do	412	838	5.69	3.30	4,771
Sept. 18	do	403	685	4.70	2.70	3,219
Oct. 20	do	377	576	3.88	2.48	2,235
Nov. 9	do	363	466	3.66	2.30	1,565
Nov. 30	do	.....	.....	.....	4.28	1,250*e*
Dec. 21	W. K. Broughton	.....	.....	.....	5.87	1,195*e*

e Estimated, from gauge height and winter curve.

DAILY GAUGE HEIGHT AND DISCHARGE of Bow river near Kananaskis, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.25*ab*	820	4.26	878	2.27	1,055	2.11	1,122	2.03*a*	953	2.63	2,492
2	4.26*a*	770	4.29	884	2.80	1,070	2.16	1,235	1.98	850	2.65	2,552
3	4.24*a*	760	4.29	886	3.01	1,080	2.42	1,884	2.02	932	2.60	2,400
4	4.28*a*	760	4.28	895	3.05	1,080	2.48	2,046	2.14	1,190	2.62	2,461
5	4.25*a*	760	4.36	895	3.32	1,085	2.24	1,421	2.31	1,592	2.60	2,400
6	4.20*a*	760	4.42	905	3.40	1,092	2.22	1,373	2.47	2,019	2.62	2,461
7	4.23*a*	759	4.48	920	3.57	1,110	2.49	2,073	2.49	2,073	2.65	2,552
8	4.25	759	4.47	948	3.66	1,120	2.47	2,019	2.48	2,046	2.58	2,340
9	4.26	759	4.47	963	3.60*a*	1,130	2.21	1,349	2.52	2,160	2.80	3,025
10	4.25	760	4.43	980	3.20*a*	1,140	2.24	1,421	2.54	2,220	2.90	3,370
11	4.20	762	4.40	990	2.80*a*	1,142	2.44	1,938	2.44	1,938	2.92	3,443
12	4.11	764	4.40	995	2.45*a*	1,145	2.09	1,079	2.49	2,073	2.85	3,197
13	4.23	770	4.40	995	2.27	1,150	2.08	1,058	2.51	2,130	2.88	3,301
14	4.16	780	4.41	990	2.21*b*	1,155	2.07	1,037	2.43	1,911	2.95	3,552
15	4.14	800	4.43	992	2.10	1,100	2.09	1,079	2.34	1,671	3.22	4,597
16	4.16	818	4.40	1,000	2.08	1,058	2.19	1,303	2.30	1,565	3.85	7,370
17	4.20	836	4.20	1,000	2.05	995	2.21	1,349	2.31	1,592	4.38	10,188
18	4.23	840	3.70*a*	1,000	2.03	953	2.16	1,235	2.33	1,644	4.94	13,572
19	4.18	840	3.30*a*	1,000	2.07	1,037	2.12	1,145	2.30	1,565	5.54	17,379
20	4.16	838	2.95*a*	1,000	2.11	1,122	2.15	1,212	2.40	1,830	5.84	19,284
21	4.14	820	2.27	1,015	2.15	1,212	2.16	1,235	2.41	1,857	6.14	21,210
22	4.15*a*	808	2.16	1,025	2.13	1,168	2.18*a*	1,280	2.44	1,938	5.93	19,857
23	4.17	805	2.08	1,030	2.11	1,122	2.16*a*	1,235	2.50	2,100	5.63	17,950
24	4.23*a*	805	2.02	1,030	2.09	1,079	2.11*a*	1,122	2.45	1,965	5.08	14,458
25	4.30*a*	804	2.00	1,027	2.05	995	2.09*a*	1,079	2.49	2,073	4.88	13,196
26	4.35	804	1.99	1,028	2.04	974	2.07*a*	1,037	2.52	2,160	4.73	12,266
27	4.38	810	2.00	1,028	2.00	890	2.05*a*	995	2.55	2,250	4.78	12,576
28	4.38	815	2.10	1,030	2.01	911	2.12*a*	1,145	2.56	2,280	5.53	17,316
29	4.39	825	2.12	1,040	2.00	890	2.19*a*	1,303	2.49	2,073	5.66	18,141
30	4.38	850	.....	.....	2.02	932	2.03*a*	953	2.51	2,130	5.48	16,998
31	4.30	870	.....	.....	2.01	911	.....	.....	2.58	2,340	.....	.....

a Gauge heights interpolated.
b Ice conditions January 1 to March 14.

DAILY GAUGE HEIGHT AND DISCHARGE of Bow river near Kananaskis, for 1916.—*Concluded.*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.73	12,266	3.22	4,597	3.31	4,967	2.51	2,130	2.40	1,830	5.00	1,330
2	4.78	12,576	3.27	4,802	3.35	5,133	2.50	2,100	2.46	1,992	3.97	1,350
3	4.93	13,509	3.44	5,508	3.28	4,843	2.49	2,073	2.33	1,644	3.09	1,320
4	4.74	12,328	3.49	5,718	3.37	5,215	2.45	1,965	2.32	1,618	2.69	1,290
5	4.88	13,196	3.52	5,848	3.48	5,676	2.38	1,777	2.40	1,830	3.13	1,330
6	4.54	11,116	3.44	5,508	3.38	5,257	2.48	2,046	2.37	1,751	3.23	1,340
7	4.45	10,590	3.35	5,133	3.25	4,720	2.43	1,911	2.30	1,565	3.18	1,336
8	4.48	10,764	3.30	4,925	3.23	4,638	2.50	2,100	2.39	1,804	3.89	1,330
9	4.71	12,142	3.36	5,174	3.27	4,802	2.43	1,911	2.31	1,591	4.03	1,330
10	5.24	15,474	3.60	6,200	3.19	4,475	2.44	1,938	2.39	1,804	5.00	1,336
11	5.34	16,109	3.48	5,676	3.09	4,077	2.45	1,965	2.27	1,493	6.18	1,340
12	5.05	14,268	3.35	5,133	3.11	4,155	2.47	2,019	2.80*b*	1,520	6.30	1,338
13	5.11	14,649	3.33	5,049	3.02	3,811	2.46	1,992	3.95	1,580	6.56	1,282
14	5.09	14,521	3.30	4,925	2.94	3,516	2.47	2,019	3.71	1,655	6.99	1,210
15	4.64	11,714	3.32	5,008	2.88	3,301	2.47	2,019	5.33	1,665	7.08	1,090
16	4.55	11,175	3.31	4,967	2.83	3,129	2.40	1,830	6.40	1,650	7.13	1,075
17	4.45	10,590	3.37	5,215	2.75	2,865	2.43	1,911	5.15	1,610	6.90*a*	1,070
18	4.54	11,116	3.40	5,340	2.72	2,769	2.43	1,911	5.12	1,540	6.67	1,080
19	4.50	10,880	3.33	5,050	2.78	2,961	2.49	2,073	3.61	1,490	6.37	1,120
20	4.45	10,590	3.26	4,761	2.65	2,552	2.49	2,073	4.19	1,590	6.07	1,180
21	4.46	10,648	3.21	4,556	2.59	2,370	2.48	2,046	4.87	1,590	5.83	1,195
22	4.51	10,939	3.15	4,315	2.55	2,250	2.46	1,992	3.19	1,580	5.56	1,200
23	4.46	10,648	3.11	4,155	2.57	2,310	2.47	2,019	2.96	1,410	5.46	1,200
24	3.75	6,895	3.05	3,925	2.50	2,100	2.48	2,046	3.21	1,430	5.26	1,200
25	3.57	6,068	3.08	4,039	2.48	2,046	2.47	2,019	3.79	1,437	5.18*a*	1,200
26	3.59	6,156	3.05	3,925	2.52	2,160	2.47	2,019	4.03	1,444	5.11	1,200
27	3.64	6,384	3.11	4,155	2.55	2,250	2.51	2,130	4.76	1,450	5.11	1,190
28	3.60	6,200	3.33	5,050	2.53	2,190	2.47	2,019	5.50	1,462	5.11	1,185
29	3.51	5,804	3.27	4,802	2.50	2,100	2.45	1,965	6.33	1,462	5.11	1,173
30	3.42	5,424	3.30	4,925	2.55	2,250	2.46	1,992	4.28	1,250	5.11	1,140
31	3.30	4,925	3.25	4,720	.....	.....	2.40	1,830	.....	.....	5.11*b*	1,118

a Gauge height interpolated.
b Ice conditions November 12 to December 31.

MONTHLY DISCHARGE of Bow river near Kananaskis, for 1916

(Drainage area 1,630 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	870	759	798	0.490	0.56	49,067
February	1,040	878	978	0.600	0.65	56,255
March	1,212	890	1,061	0.651	0.75	65,237
April	2,073	953	1,325	0.813	0.91	78,843
May	2,340	850	1,843	1.130	1.30	113,322
June	21,210	2,340	9,197	5.642	6.29	547,260
July	16,109	4,925	10.634	6.520	7.52	653,859
August	6,200	3,925	4,939	3.030	3.49	303,687
September	5,676	2,046	3,496	2.140	2.39	208,026
October	2,130	1,777	1,995	1.220	1.41	122,667
November	1,992	1,250	1,591	0.976	1.09	94,671
December	1,350	1,070	1,228	0.753	0.87	75,507
The year					27.23	2,368,401

MEAN MONTHLY DISCHARGE in Second-feet of Bow river near Kananaskis

MONTH	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October		2,510	1,840	2,158	2,026	2,128	1,855	1,995	2,073	127,471
Nov....		1,519	1,308*c*	1,259	1,507	1,218	1,394	1,591	1,415	84,176
Dec....		1,111		656	1,398	645	1,165	1,228	1,034	63,564
Jan....		593*b*		703	859	654	798		754	46,331
Feb....		615		679	646	803	978		744	41,719
March		687	580*d*	839	670	825	1,061		816	50,198
April...		827	627	1,285	808	1,093	1,325		994	59,159
May....	8,473*a*	2,229	2,200	2,546	2,583	2,570	1,843		2,328	143,168
June....	9,544	10,184	5,475	8,776	6,932	5,428	9,197		7,934	472,082
July....	7,859	8,059	6,130	5,540	6,957	8,059	10,634		7,605	467,637
August	4,829	5,759	5,923	5,049	3,528	5,134	4,939		5,023	308,995
Sept....	2,794	3,501	3,294	3,381	2,136	2,539	3,496		3,020	179,709
Total in Acre-ft.	1,632,904	2,252,531	1,614,248	1,987,964	1,821,274	1,886,866	2,344,198			2,044,209

a 25-31.
b 21-31.
c 1-8 and 27-30.
d 10-31.

Note—Above records previous to March, 1912, taken below mouth of Kananaskis river on Bow river near Morley in Sec. 22, Tp. 55, Rge. 7, W. 5th. Mer.

Drainage area for this station is 2,111 square miles.

KANANASKIS RIVER NEAR SEEBE

Location.—On the SW. ¼ Sec. 34, Tp. 24, Rge. 8, W. 5th Mer., one and one-half miles above the junction with Bow river.

Records available.—September 1, 1911, to November 11, 1911; January 1, 1912, to December 31, 1916.

Gauge.—Chain; elevation of zero maintained at 88.17 feet since April 20, 1912. Previous to April 20, 1912, gauge readings were at old station, one and one-half miles down stream.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—Permanent.

Discharge measurements.—Made from a cable.

Observer.—The Calgary Power Company.

Accuracy.—The gauge records are taken daily at this station to one-hundredth of a foot, at the time of mean daily gauge height.

Discharge measurements were plotted from two curves, which were necessitated by a change at the control during the period of high water between July 24 and August 10. The points plotted are penetrated by either one or other of these two curves with the exception of two points which plot very close to the curve.

The results are well within the limit of error.

The winter discharges are based upon graphs, derived by using the daily gauge heights, occasional measurements and temperature graphs and are fairly good estimates.

DISCHARGE MEASUREMENTS of Kananaskis river near Seebe, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Feb. 26	H. C. Ritchie	80	85	1.38	6.14	117
Mar. 20	do	105	203	0.90	4.76	182
April 13	do	106	208	0.86	4.78	178
May 1	do	111	237	1.15	5.04	272
May 22	do	115	282	1.69	5.46	478
June 14	do	128	476	4.86	7.08	2,312
June 21	A. B. Cook	132	689	8.41	8.73	5,786
June 25	do	126	544	6.69	7.66	3,634
July 24	H. C. Ritchie	127	357	5.68	6.83	2,025
Aug. 10	do	126	324	5.98	6.84	1,612
Aug. 30	do	125	288	4.82	6.63	1,387
Sept. 19	do	121	232	3.85	6.10	893
Oct. 20	do	127	175	2.50	5.42	437
Nov. 10	do	113	155	2.25	5.15	348
Nov. 30	do	99	135	2.05	5.01	276
Dec. 22	W. K. Broughton	127	217	0.76	7.40	166

Daily Gauge Height and Discharge of Kananaskis river near Seebe, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	7.03*b*	202	9.24	120	6.19	122	4.71*a*	163	5.04*a*	273	5.79	742
2	7.05	197	9.24	119	6.67*a*	123	4.73*a*	160	5.08	291	5.83	777
3	7.12	194	8.99	118	7.16*a*	125	4.74*a*	172	5.17	332	5.90	840
4	7.19*a*	191	8.76	117	7.66*a*	127	4.77*a*	181	5.19	341	6.16	998
5	7.26*a*	188	8.74	117	8.16*a*	130	4.78*a*	184	5.24	367	6.20	1,140
6	7.33*a*	184	8.60	117	8.64*a*	133	4.80*a*	190	5.28	389	6.30	1,260
7	7.38*a*	180	8.56	116	9.11	135	4.82*a*	196	5.26	378	6.30	1,260
8	7.43*a*	176	8.66	115	9.27	138	4.84*a*	202	5.27	383	6.27	1,224
9	7.47	172	8.43	115	8.63*a*	140	4.85*a*	205	5.44	481	6.55	1,575
10	7.50	168	8.43	114	7.98*a*	143	4.88*a*	214	5.43	475	6.65	1,717
11	7.22	163	8.23	113	7.35*a*	147	4.83*a*	199	5.40	455	6.57	1,603
12	7.19	166	8.15	114	6.70*a*	152	4.92	227	5.38	444	6.45	1,442
13	7.47	165	8.00	116	6.06	155	4.88	214	5.42	468	6.51	1,519
14	7.16	160	7.80	119	6.05	158	4.86	208	5.39	450	6.80	1,940
15	7.30	156	8.91	120	5.87	161	4.89	217	5.38	444	7.31	2,809
16	7.33	158	7.89	120	5.17	164	4.90	220	5.36	433	7.92	4,057
17	7.35	158	7.81	119	4.75*b*	167	4.87	211	5.39	450	9.00	6,325
18	6.93	156	7.29*a*	119	4.69	158	4.89	217	5.35	428	9.50	7,375
19	6.73	154	6.77*a*	118	4.71*a*	163	4.90	220	5.37	438	9.35	7,060
20	6.68	150	6.52*a*	118	4.74*a*	172	4.88	214	5.40	455	9.15	6,640
21	6.60	146	6.26	118	4.68*a*	156	4.84	202	5.40	455	8.75	5,800
22	6.65*a*	143	6.24	118	4.70	160	4.87	211	5.43	475	8.25	4,750
23	6.70	139	6.16	119	4.74	172	4.89*a*	217	5.49	514	7.80	3,805
24	7.25*a*	136	6.06	118	4.72	166	4.90*a*	220	5.45	487	7.65	3,490
25	7.80*a*	133	6.80	118	4.71	163	4.92*a*	227	5.43	475	7.50	3,175
26	8.35*a*	130	6.13	117	4.72	166	4.94*a*	234	5.47	501	7.76	3,721
27	8.90	128	6.11	118	4.72	166	4.96*a*	241	5.48	507	7.73	3,658
28	9.55	126	6.15	120	4.71	163	4.98*a*	248	5.50	520	8.23	4,708
29	9.50	124	6.20	120	4.71	163	5.00*a*	255	5.59	583	8.26	4,771
30	9.45	123	.....	.....	4.72	166	5.02*a*	264	5.64	622	7.86	3,931
31	9.50	122	.....	.....	4.70	160	.....	.....	5.75	710	.....	.....

a Gauge height interpolated.
b Ice conditions, January 1 to March 17.

DAILY GAUGE HEIGHT AND DISCHARGE of Kananaskis river near Seebe, for 1916—*Concluded*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	7.63	3,448	6.64	1,520	6.59	1,344	5.98	790	5.29	394	5.03	268
2	7.71	3,716	6.65	1,500	6.55	1,302	5.85	697	5.27	385	5.01	260
3	8.05	4,330	6.72	1,560	6.53	1,282	5.78	652	5.28	389	5.00	256
4	7.87	3,952	6.68	1,520	6.96	1,791	5.69	594	5.25	377	4.98	254
5	7.67	3,532	6.70	1,520	7.26	2,228	5.66	578	5.26	381	4.97	250
6	7.33	2,847	6.67	1,470	7.05	1,915	5.66	578	5.23	368	4.95	245
7	7.41	3,000	6.63	1,420	6.80	1,580	5.60	545	5.21	359	4.96	240
8	7.48	3,136	6.57	1,310	6.74	1,511	5.56	524	5.19	351	4.98	232
9	7.50	3,175	6.64	1,380	6.76	1,534	5.53	508	5.16	339	4.99	220
10	7.80	3,805	6.92	1,737*s*	6.55	1,302	5.51	497	5.10	316	5.37	218
11	7.85	3,910	6.71	1,477	6.51	1,260	5.49	487	5.06	302	6.27	211
12	7.53	3,238	6.58	1,334	6.56	1,313	5.47	477	7.43*b*	300	6.40	200
13	7.46	3,097	6.62	1,377	6.47	1,220	5.44	462	8.20	300	6.21	196
14	7.53	3,238	6.57	1,324	6.33	1,083	5.43	457	7.87	300	6.45	190
15	7.32	2,828	6.55	1,302	6.30	1,055	5.43	457	7.42	295	6.49	186
16	7.01	2,277	6.52	1,271	6.24	1,004	5.41	447	7.46	295	6.46	185
17	7.05	2,345	6.63	1,388	6.15	927	5.42	452	7.53	295	6.90*a*	180
18	7.49	3,155	6.69	1,454	6.08	869	5.43	457	6.44	292	7.94	179
19	7.33	2,847	6.76	1,534	6.11	893	5.42	452	5.40	290	7.44	177
20	7.24	2,680	6.77	1,545	6.07	861	5.42	452	5.15	290	6.94	173
21	7.19	2,588	6.70	1,465	6.01	813	5.42	452	5.00	286	6.68	169
22	7.15	2,518	6.65	1,410	6.03	829	5.40	442	5.03	285	7.43	166
23	7.04	2,328	6.71	1,477	5.97	782	5.37	429	5.01	284	7.87	166
24	6.83	1,985	6.86	1,658	5.95	768	5.37	429	4.89	280	8.47	165
25	7.02	2,335*s*	6.97	1,804	5.97	782	5.33	411	5.00	284	8.87	165
26	6.89	2,100	6.90	1,710	5.90	730	5.36	424	5.01	284	9.47	164
27	6.97	2,200	6.77	1,545	5.95	768	5.33	411	5.05	280	9.02	164
28	7.03	2,265	6.79	1,569	5.98	790	5.33	411	5.07	278	8.43	163
29	6.82	1,900	6.79	1,569	5.96	775	5.32	407	5.03	274	8.69	162
30	6.76	1,760	6.66	1,421	6.06	853	5.29	394	5.05	276	8.31	161
31	6.72	1,660	6.61	1,366	.....	.....	5.29	394	.....	.....	8.93*b*	160

a Gauge height interpolated.
b Ice conditions, November 12 to December 31.
s Shifting conditions, July 25 to August 10.

MONTHLY DISCHARGE of Kananaskis river near Seebe, for 1916

(Drainage area 392 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	202	122	158	0.403	0.46	9,715
February	120	113	117	0.298	0.32	6,730
March	172	122	152	0.388	0.45	9,346
April	264	163	211	0.538	0.60	12,555
May	710	273	452	1.153	1.33	27,792
June	7,375	742	3,137	8.003	8.93	186,664
July	4,330	1,660	2,845	7.258	8.37	174,932
August	1,804	1,271	1,482	3.781	4.36	91,125
September	2,228	730	1,139	2.906	3.24	67,775
October	790	394	467	1.191	1.37	28,715
November	394	274	314	0.801	0.89	18,684
December	268	160	198	0.505	0.58	12,175
The year	.....	.....	.....	.....	30.90	646,208

MEAN MONTHLY DISCHARGE in Second-feet of Kananaskis river near Seebe

MONTH	1910-11	1911-12	1912-13	1913-14	1914-15	1915-16	1916-17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	300	376	507	542	480	467	445	27,382
November	.....	152*a*	252	306	311	328	314	302	17,982
December	.....	.....	204	226	197	266	198	218	13,417
January	.....	136	168	142	97	158	.....	140	8,614
February	.....	129	169	143	145	117	.....	141	7,904
March	.....	129	136	153	133	152	.....	141	8,644
April	.....	128	178	169	200	211	.....	177	10,548
May	.....	477	492	722	921	452	.....	613	37,675
June	.....	1,582	1,712	1,653	1,893	3,137	.....	1 995	118,734
July	.....	1,996	1,245	1,701	2,0.0	2,845	.....	1,959	120,478
August	.....	1,424	1,277	961	1,363	1,482	.....	1,301	79,283
September	715	653	989	599	811	1,139	.....	818	48,654
Total in acre-feet	42,545	425 650	431,679	441,492	522,969	652,021	.....	.....	499,315

a 1-11.

GHOST RIVER AT GILLIES' RANCH

Location.—On the NE. ¼ Sec. 23, Tp. 26, Rge. 6, W. 5th Mer., one mile above the junction with Bow river.

Records available.—August 17, 1911, to November 11, 1911; January 1, 1912, to December 31, 1916.

Gauges.—Chain, on left bank: Elevation of zero maintained at 91.15 feet, 1911-13; elevation of zero maintained at 89.22 feet from January 1, 1914, to June 26, 1915.

Staff: Elevation of zero maintained at 91.67 feet from June 27, 1915, to June 28, 1916.

Stevens continuous water stage recorder: Elevation of zero maintained at 91.49 feet from June 29, 1916, to December 31, 1916.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—Shifting at each high stage.

Discharge measurements.—Made by wading; at high stages made at traffic bridge one mile down stream.

Observer.—Miss E. Gillies.

Accuracy.—The gauge heights are recorded during the winter season to one-hundredth of a foot by an observer.

During the open water season, a continuous water stage recorder is used as a base for computations.

The discharges all plotted on a curve up to June 23, after which date there was a gradual change in the control until the end of the open water season, and the Bolster method was used in obtaining discharges under shifting conditions.

During the winter the discharges were based on a graph formed by the use of daily gauge height temperatures and occasional discharge measurements, which will be found fairly accurate estimates.

From March 10 to 27, no gauge height observations were made and the discharges are estimated.

Discharge Measurements of Ghost river at Gillies' Ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height		Discharge
					Staff	Auto	
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Feet*	*Sec.-ft.*
Jan. 6	H. C. Ritchie	20	86.5	1.59	4 28		137
Feb. 4	do	25	36.0	2.80	5.08		100
Mar. 9	do	25	36.0	2.80	6.68		100*e*
April 11	do	79	95.8	2.97	3.21		284
May 4	do	98	149.0	2.32	3.28	0.99	345
May 25	do	73	87.8	2.70	3.10	0.71	236
June 13	do	78	219.0	2.67	3.57	1.38	586
June 23	A. B. Cook	90	295.0	4.17	4.07	2.26	1,230
July 22	H. C. Ritchie	68	173.0	3.48		2.20	603
Aug. 8	do	98	130.0	3.85		1.83	501
Aug. 29	do	70	241.0	2.93		2.05	706
Sept. 27	do	102	148.0	3.83		2.18	568
Oct. 19	do	99	131.6	4.58		2.02	603
Nov. 6	do	98	107.0	3.32		1.80	356
Nov. 29	do	96	93.3	2.89		1.60	270
Dec. 20	W. K. Broughton	90	104.0	2.00		1.72	207

e Estimated from velocity and area.

Daily Gauge Height and Discharge of Ghost river at Gillies' Ranch, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.88*bc*	160	4.70	103	3.48	102	2.96	187	3.27	325	3.96	1,083
2	3.95	154	4.77	102	3.53	102	3.61	638	3.42	440	3.90	1,000
3	3.95	148	4.77	100	3.53	102	3.71	758	3.27	325	4.22	1,448
4	3.27	144	5.08	100	3.68	102	3.61	638	3.27	325	4.42	1,733
5	3.45	140	5.03	100	6.48	101	3.00	198	3.22	293	4.21	1,434
6	4.28	137	3.88	100	6.53	100	3.41	430	3.07	224	4.06	1,224
7	4.39	136	3.98	102	6.58	100	3.43	449	3.03	209	3.86	948
8	4.45	133	4.90	104	6.58	100	3.49	508	2.97	190	3.92	1,028
9	4.50	131	4.28	106	6.68*c*	100	3.45	469	2.84	157	3.92	1,028
10	4.56	128	3.86	112	.....	101	3.71	758	2.82	152	3.92	1,028
11	4.92	126	3.72	115	.....	101	3.21	286	2.82	152	3.60	626
12	4.48	124	4.89	118	.....	102	3.16	262	2.82	152	3.60	626
13	4.14	123	4.83	119	.....	102	3.12	244	2.82	152	3.58	604
14	4.15	124	4.82	120	.....	105	3.26	318	2.93	178	3.76	821
15	4.16	127	6.33	120	.....	109	3.37	397	2.93	178	4.23	1,462
16	4.17	133	6.33	120	.....	116	3.11	240	2.95	184	4.57	1,954
17	4.15	135	6.32	120	.....	122	3.35	382	2.93	178	4.49	1,835
18	3.99	135	5.18	119	.....	129	3.10	235	2.94	181	4.50	1,850
19	3.98	134	5.23	118	.....	139	3.09	231	2.89	168	4.47	1,806
20	4.00	132	4.88	116	.....	150	3.11	240	3.05	216	5.77	3,730
21	4.01	126	4.87	114	.....	161	3.05	216	2.96	187	4.79	2,279
22	4.12*a*	122	4.78	112	.....	173	2.90	170	2.97	190	4.15	1,350
23	4.23*a*	115	4.73	110	.....	185	2.89	168	3.09	231	4.07	1,238
24	4.34	111	4.34	108	.....	198	2.89	168	3.16	262	3.88	974
25	4.37*a*	107	4.18	106	.....	215	3.04	213	3.11	240	3.90	1,000
26	4.40*a*	105	4.13	104	.....	235	3.24	306	3.30	344	3.96	1,083
27	4.44*a*	105	3.98	103	3.03*b*	209	3.24	306	3.52	540	4.66	2,087
28	4.47	106	3.90	103	3.09	231	3.24	306	3.56	583	5.66	3,567
29	4.47	106	3.78	103	3.11	240	3.01	202	3.87	961	3.66	2,150*s*
30	4.44	106	.....	.....	2.91	173	3.18	271	3.92	1,028	2.02	922*n*
31	4.45	105	.....	.....	3.01	202	.....	.....	4.02	1,168	.....	.....

a Gauge height interpolated.
b Ice conditions—January 1 to March 26.
s Shifting conditions, June 29 to November 5.
c Winter gauge, January 1 to March 9. *m* Summer gauge, March 27 to June 29.
n Automatic outside staff gauge, June 29-30.

DAILY GAUGE HEIGHT AND DISCHARGE of Ghost river at Gillies' Ranch, for 1916—*Concluded*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.53*c*	1,267	1.98	542	2.14	748	2.13	556	1.85	418	1.65*b*	270
2	2.89	1,508	1.97	542	2.26	824	2.11	548	1.87	423	1.70	266
3	3.13	1,664	2.01	580	3.31	1,584	2.10	548	1.79	374	1.65	260
4	2.93	1,496	1.99	580	3.04	1,380	2.07	532	1.80	372	1.60	255
5	2.38	1,072	1.95	555	2.69	1,112	2.08	546	1.83	378*s*	1.60	245
6	2.25	960	1.94	556	2.46	938	2.13	592	1.80	357	1.62	232
7	2.41	1,056	1.86	502	2.37	860	2.09	564	1.80	357	1.61	225
8	2.69	1,244	1.87	512	2.33	824	2.06	552	1.82	367	1.61	223
9	2.62	1,172	2.22	790	2.33	814	2.06	558	1.83	372	1.60	223
10	2.39	980	2.19	770	2.30*a*	785	2.07	570	1.80	357	1.70	228
11	2.32	912	2.04	660	2.30*a*	776	2.08	586	1.76	338	1.70	237
12	2.39	942	1.96	604	2.29*a*	762	2.09	600	1.75	334	1.70	238
13	2.42	940	1.91	568	2.29*a*	756	2.09	607	1.75	334	1.70	236
14	2.29	826	1.91	570	2.28*a*	740	2.09	615	1.65	290	1.70	234
15	2.25	780	1.89	558	2.28*a*	733	2.09	623	1.65	290	1.85	231
16	2.25	760	1.93	590	2.20	668	2.08	622	1.66	294	1.76	227
17	2.30	776	2.03	668	2.21	665	2.14	672	1.66	294	1.75	223
18	2.55	938	3.10	1,460	2.18	636	2.09	645	1.66	294	1.75	215
19	2.46	852	3.23	1,554	2.16	612	2.04*m*	604	1.70	310	1.85	209
20	2.34	744	2.60	1,090	2.14	587	2.02*c*	596	1.70	310	1.72	207
21	2.16*c*	595	2.40	924	2.17	606	2.02	593	1.70	310	1.69	196
22	2.20	604	2.37	924	2.28	678	2.01	582	1.72	319	1.69	195
23	2.21*m*	618	2.48	1,008	2.27	667	2.00	570	1.70	310	1.69	194
24	2.18	607	2.43	970	2.26	653	2.00	563	1.66	294	1.68	192
25	2.27	686	2.26	848	2.25	638	2.00	556	1.65	290	1.84*a*	188
26	2.28	702	2.21	816	2.24	624	2.01	556	1.65	290	1.99	185
27	2.24	680	2.15	776	2.11	518	2.00	546	1.64	286	2.04	183
28	2.16	628	2.14	772	2.09	510	1.95	506	1.64	286	2.03	180
29	2.11	604	2.13	768	2.08	508	1.90	468	1.60	270	2.06	180
30	2.07	590	2.16	778	2.12	542	1.85	426	1.60	270	2.06	180
31	2.05	582	2.15	764	.....	.....	1.85	423	.....	.....	2.98*cb*	180

a Gauge height interpolated.
b Ice conditions, December 1-31.
s Shifting conditions, June 29 to November 5.
c Automatic, outside, staff gauge July 1-21 and October 20 to December 31.
m Automatic gauge, July 23 to October 19.

MONTHLY DISCHARGE of Ghost river at Gillies' Ranch, for 1916

(Drainage area 375 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	160	105	126	0.336	0.39	7,747
February	120	100	110	0.293	0.30	6,327
March	240	100	142	0.379	0.44	8,731
April	758	168	340	0.907	1.01	20,231
May	1,168	152	326	0.869	1.00	20,045
June	3,730	626	1,464	3.904	4.36	87,114
July	1,664	582	896	2.389	2.75	55,093
August	1,554	502	761	2.029	2.34	46,792
September	1,584	508	758	2.021	2.26	45,104
October	672	423	565	1.507	1.73	34,740
November	423	270	326	0.869	0.97	19,398
December	270	180	217	0.579	0.67	13,343
The year	.....	.....	.....	.....	18.22	364,665

MEAN MONTHLY DISCHARGE in Second-feet of Ghost river at Gillies' ranch

MONTH	1910-11	1911-12	1912-13	1913-14	1914-15	1915-16	1916-17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	291	395	289	227	417	565	364	22,382
November	.....	219b	278	230	194	314	326	268	15,971
December	.....	.....	196	189	113	244	217	192	11,793
January	.....	128	148	128	107	126	.....	127	7,827
February	.....	99	132	107	94	110	.....	108	6,108
March	.....	115	108	113	95	142	.....	115	7,052
April	.....	134	212	143	135	340	.....	193	11,468
May	.....	358	316	169	334	326	.....	301	18,482
June	.....	300	371	268	1,301	1,464	.....	741	44,077
July	.....	1,073	553	278	1,453	896	.....	851	52,301
August	773a	653	428	243	986	761	.....	614	37,766
September	505	545	353	206	574	758	.....	490	29,167
Total in acre-feet	53,048	229,669	211,400	142,977	340,202	356,511	.....	.....	264,394

a 17-31.
b 1-11.

JUMPINGPOUND CREEK NEAR JUMPING POUND

Location.—On the SE. ¼ Sec. 30, Tp. 24, Rge. 4, W. 5th Mer., near Jumping Pound post office.

Records available.—April 19, 1908, to October 31, 1916. Discharge measurements only, June, 1906.

Gauge.—Vertical staff attached to bridge pile; elevation of zero has been maintained at 89.82 feet since establishment.

Bench-mark.—Permanent iron bench-mark on right bank; assumed elevation 100.00 feet.

Channel.—Permanent.

Discharge measurements.—At high water, made from highway bridge; at ordinary stage by wading down stream.

Winter flow.—No winter records have been obtained.

Observer.—John Bateman.

DISCHARGE MEASUREMENTS of Jumpingpound creek near Jumping Pound, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 10	H. C. Ritchie	78.0	80.0	1.61	2.46	129
May 5	do	65.0	91.0	1.62	2.48	147
June 12	do	107.5	292.0	2.46	3.24	717
June 24	A. B. Cook	89.0	240.0	2.03	2.95	487
July 21	H. C. Ritchie	64.0	86.0	1.56	2.27	134
Aug. 7	do	52.0	69.0	1.04	2.09	72
Aug. 28	do	74.0	117.0	2.43	2.67	284
Sept. 20	do	73.0	104.0	1.76	2.43	182
Oct. 18	do	74.0	106.5	1.73	2.40	184
Nov. 8	do	63.0	52.4	2.34	2.12	123

DAILY GAUGE HEIGHT AND DISCHARGE of Jumpingpound creek near Jumping Pound, for 1916

DAY	April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			2.20	112	4.13	1,931
2			2.60	256	4.43	2,408
3			2.50	212	4.63	2,728
4			2.56	238	4.68	2,808
5			2.46	197	4.13	1,931
6			2.43	186	3.88	1,550
7			2.39	172	3.78	1,403
8			2.35	158	3.83	1,476
9			2.33	152	3.85	1,506
10	2.46	197	2.32	149	3.81	1,447
11	2.46	197	2.29	139	3.53	1,060
12	2.46	197	2.27	133	3.54	1,073
13	2.47	201	2.28	136	3.34	833
14	2.46	197	2.32	149	3.74	1,344
15	2.46	197	2.34	155	3.99	1,715
16	2.46	197	2.32	149	4.24	2,104
17	2.36	162	2.34	155	4.39	2,184
18	2.32	149	2.45	194	4.40	2,360
19	2.29	139	2.50	212	4.30	2,200
20	2.26	130	2.48	205	4.15	1,962
21	2.21	115	2.46	197	4.10	1,884
22	2.19	110	2.56	238	3.40	900
23	2.18	107	2.61	261	3.13	617
24	2.15	100	2.69	303	2.81	372
25	2.13	94	2.81	372	2.86	404
26	2.13	94	2.85	398	2.86	404
27	2.14	97	2.96	474	3.06	555
28	2.14	97	3.91	1,595	3.96	1,670
29	2.16	102	3.62	1,178	3.85	1,506
30	2.19	110	3.62	1,178	4.15	1,962
31			4.12	1,915		

DAILY GAUGE HEIGHT AND DISCHARGE of Jumpingpound creek near Jumping Pound, for 1916 —*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.15	636	2.21	115	2.63	272	2.35	158
2	3.20	683	2.17	105	2.65	282	2.40	175
3	3.20	683	2.17	105	3.13	617	2.45	194
4	3.15	636	2.18	107	5.13	3,528	2.45	194
5	3.09	580	2.13	95	5.33	3,848	2.40	175
6	2.99	497	2.11	90	4.98	3,288	2.35	158
7	2.94	460	2.10	87	4.54	2,584	2.33	152
8	3.04	538	2.19	110	4.14	1,946	2.29	139
9	2.89	424	2.74	331	3.64	1,205	2.29	139
10	2.74	331	2.64	277	3.34	833	2.33	152
11	2.68	298	2.64	277	3.14	627	2.35	158
12	2.65	282	2.44	190	3.04	538	2.36	162
13	2.63	272	2.34	155	2.79	360	2.33	152
14	2.61	261	2.32	149	2.74	331	2.31	145
15	2.58	247	2.29	139	2.64	277	2.30	142
16	2.52	221	2.27	133	2.56	238	2.29	139
17	2.47	201	2.22	118	2.54	230	2.29	139
18	2.47	201	3.32	810	2.52	221	2.28	136
19	2.42	182	5.14	3,544	2.49	208	2.33	152
20	2.34	155	3.94	1,640	2.47	201	2.31	145
21	2.26	130	3.64	1,205	2.45	194	2.33	152
22	2.26	130	3.49	1,009	2.40	175	2.30	142
23	2.24	124	3.43	936	2.35	158	2.29	139
24	2.21	115	3.33	822	2.33	152	2.28	136
25	2.23	121	3.13	617	2.30	142	2.28	136
26	2.27	133	2.93	452	2.31	145	2.28	136
27	2.32	149	2.78	354	2.30	142	2.27	133
28	2.30	142	2.68	298	2.29	139	2.27	133
29	2.30	142	2.63	272	2.29	139	2.26	130
30	2.25	127	2.58	247	2.31	145	2.26	130
31	2.28	136	2.53	225			2.25	127

MONTHLY DISCHARGE of Jumpingpound creek near Jumping Pound, for 1916

(Drainage area 187 square miles.)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
April (10-30)	201	94	142	0.759	0.59	5,913
May	1,915	112	373	2.000	2.31	22,935
June	2,808	372	1,543	8.250	9.20	91,815
July	683	115	298	1.590	1.83	18,323
August	3,544	87	484	2.590	2.99	29,760
September	3,848	139	772	4.130	4.61	45,937
October	194	127	148	0.791	0.91	9,100
The period					22.44	223,783

MEAN MONTHLY DISCHARGE in Second-feet of Jumpingpound creek near Jumping Pound

MONTH	1907–8	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	*a*40	20.0	16.5	*c*115	105	26.0	26	129	148	67	4,129
November	.....	.....	.....	.....	.....	*d*95	.....	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
March	.....	.....	.....	.....	.....	.....	.....	*g*66	.....	.....	.....	.....
April	.....	.....	*b*12.8	.....	45	*e*88	*f*143.0	28	*h*142	.....	36	1,418
May	.....	223	22.0	127.0	176	144	57.0	342	373	.....	183	11,255
June	415	189	41.0	216.0	212	221	70.0	1,042	1,543	.....	439	26,101
July	102	121	6.6	205.0	708	119	40.0	968	298	.....	285	17,545
August	50	62	8.9	357.0	223	134	18.5	241	484	.....	175	10,778
September	29	25	64.0	184.0	145	52	11.6	138	772	.....	158	9,387
Total in acre-feet	35,714	39,689	10,341	67,181	94,741	52,701	21,274	171,062	222,615	.....	.....	80,613

a 1-26.
b 9-30.
c 1-19.
d 1-15.
e 15-30.
f 4-30.
g 15-31.
h 10-30.

BOW RIVER NEAR COCHRANE

Location.—On the SW. ¼ Sec. 35, Tp. 25, Rge. 4, W. 5th Mer., near Cochrane post office.

Records available.—May 4, 1916, to July 11, 1916.

Gauge.—Vertical staff attached to the downstream end of the third pier from the left bank. Elevation of zero has been maintained at 88.60 since establishment.

Bench-mark.—Small bolt on downstream side of fourth pier from left bank; assumed elevation 100.00 feet.

Channel.—Permanent.

Discharge measurements.—From highway bridge.

Floods.—The stream was in flood June 21, maximum gauge height 6.33. The stream did not overflow its banks.

Winter measurements.—None made. This station is maintained during high water only, for the purpose of issuing flood warnings.

Observer.—Geo. P. Rattray.

Remarks.—As this station is only maintained during high water and for flood prediction purposes, daily and monthly discharges are not prepared or published.

DISCHARGE MEASUREMENTS of Bow river near Cochrane, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
May 27	H. C. Ritchie	345	851	4.04	0.55	3,440
June 14	do	368	1,352	5.89	2.00	7,962
June 20	A. B. Cook	420	2,907	9.68	5.77	28,130
June 24	do	402	2,315	8.87	4.41	20.528

BOW RIVER AT CALGARY

Location.—On the NE. ¼ Sec. 15, Tp. 24, Rge. 1, W. 5th Mer., at Langevin traffic bridge on 4th St. E., in the city of Calgary.

Records available.—May 5, 1908, to December 31, 1916.

Gauges.—Standard chain type on Langevin bridge; elevation of zero maintained at 3,405.37 feet during 1912-1916. Gurley automatic gauge on central pier; elevation of zero maintained at 3,405.37 feet during 1914-1916.

Bench-mark.—Zero of staff gauge embedded in concrete of centre pier is 3,409.98 feet. This is referred to a bench-mark of the Topographical Surveys Branch on the northeast wing wall of the bridge, the elevation of which is 3,428.99 feet.

Channel.—Coarse gravel, shifting in floods.

Discharge measurements.—Made from bridge.

Observer.—C. L. Lang.

Accuracy.—Gauge heights at this station are read daily to one-hundredth of a foot, and are accurate.

The open water discharge curve passes through nine points, and in close proximity to all the remainder, and the discharges are all well within the limit of error. The curve is smooth and well defined.

The winter discharges are based on a graph, which is, in its turn, based upon daily gauge heights, temperatures and frequent measurements and would be considered fair estimates.

DISCHARGE MEASUREMENTS of Bow river at Calgary, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 4-5	F. K. Beach				4.94	1,000e
Jan. 17	O. H. Hoover	318	1,184	0.62	8.04	729
Feb. 2	do	340	966	1.44	8.56	1,392
Mar. 3	S. H. Frame	290	595	1.79	6.43	1,065
Mar. 18	E. J. Switzer	305	826	1.85	6.80	1,524
April 8	O. H. Hoover	305	666	3.33	5.24	2,219
April 28-29	W. K. Broughton	287	641	2.54	4.07	1,628
May 19	do	306	682	2.78	4.40	1,897
June 2	do	313	1,262	4.55	5.84	5,745
June 19	W. H. Storey	356	2,882	7.66	9.94	22,076
June 20	do	356	3,008	7.87	10.24	23,673
June 21	do	356	3,082	8.93	10.54	27,536
June 22	W. K. Broughton	360	2,870	8.50	10.04	24,393
June 24	do	356	2,517	7.66	8.99	19,284
June 27	R. J. McGuinness	358	2,705	8.15	9.63	22,040
July 11	W. K. Broughton	337	2,682	7.82	8.95	20,971
July 21	do	335	2,189	5.92	7.51	12,761
July 22	do	334	2,123	5.70	7.30	12,102
July 31	R. J. McGuinness	324	1,650	4.49	6.15	7,409
Aug. 23	W. K. Broughton	326	1,824	4.60	6.49	8,389
Sept. 13	do	323	1,705	4.00	6.02	6,813
Oct. 3	do	300	1,354	2.84	4.90	3,849
Oct. 27	do	292	1,299	2.49	4.64	3,232
Nov. 21	do	278	1,192	2.10	4.32	2,502
Dec. 7	do	253	1,113	1.31	4.02	1,458
Dec. 27	C. M. O'Neil	219	860	0.87	4.31	744

e Discharge estimated.

Daily Gauge Height and Discharge of Bow river at Calgary, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	*b*	1,040	.....	1,380	.....	1,100	4.68	2,130	4.06	2,100	6.09	7,266
2	.....	1,030	8.52	1,390	.....	1,070	4.99*a*	2,160	4.28	2,466	5.96	6,828
3	4.89	1,040	8.60	1,370	6.43	1,065	5.30	2,170	4.25	2,415	6.26	7,868
4	4.91	1,050	8.27	1,330	.....	1,080	4.80	2,170	4.35	2,590	6.46	8,628
5	5.26	1,100	8.37*a*	1,320	.....	1,130	4.62	2,180	4.43	2,737	6.37	8,286
6	4.86	1,110	8.48*a*	1,320	.....	1,200	5.47	2,180	4.61	3,102	6.16	7,504
7	5.06	1,120	8.59	1,330	.....	1,240	5.30	2,210	4.66	3,212	6.08	7,232
8	5.50	1,150	8.54*a*	1,340	6.77	1,260	5.16	2,220	4.76	3,438	6.06	7,164
9	5.67*a*	1,180	8.49	1,345	6.57	1,300	5.23	2,220	4.66	3,212	6.14	7,436
10	5.84	1,200	8.50*a*	1,350	6.85	1,375	5.26*b*	2,230	4.59	2,959	6.29	7,982
11	5.64	1,180	8.51	1,355	7.67	1,450	4.06	2,100	4.54	2,954	6.14	7,436
12	5.37	1,140	8.40*a*	1,350	.....	1,480	4.08	2,130	4.39	2,662	6.09	7,266
13	5.69	1,060	8.30	1,320	.....	1,490	4.05	2,0 5	4.39	2,662	6.03	7,062
14	6.05	930	8.45*a*	1,315	.....	1,500	4.00	2,010	4.34	2,572	6.28	7,944
15	6.66	800	8.60*a*	1,330	.....	1,510	4.07	2,115	4.32	2,536	6.96	10,564
16	7.36	750	8.75*a*	1,355	.....	1,510	3.90	1,880	4.26	2,432	7.89	14,505
17	8.04	730	8.90	1,370	.....	1,520	3.94	1,932	4.25	2,415	8.72	18,240
18	.....	750	8.00	1,360	6.80	1,525	3.94	1,932	4.34	2,572	9.49	21,741
19	.....	1,000	7.80	1,330	.....	1,565	3.92	1,906	4.39	2,662	10.09	24,873
20	.....	1,200	7.49	1,275	.....	1,650	3.93	1,929	4.54	2,954	10.14	25,158
21	.....	1,240	.....	1,230	.....	1,780	3.93	1,929	4.59	2,959	10.46	27,078
22	.....	1,245	.....	1,220	.....	1,825	3.87	1,841	4.68	3,256	10.04	24,588
23	.....	1,250	.....	1,200	.....	1,855	3.89	1,867	4.67	3,234	9.44	21,496
24	.....	1,250	.....	1,180	.....	1,875	3.84	1,802	4.81	3,553	8.94	19,230
25	.....	1,255	.....	1,150	.....	1,900	3.88	1,854	4.84	3,622	8.68	18,060
26	.....	1,260	.....	1,130	.....	1,930	3.78	1,724	4.84	3,622	8.76	18,420
27	.....	1,260	.....	1,100	.....	1,975	3.93	1,919	4.89	3,737	9.45	22,040*s*
28	.....	1,270	.....	1,100	.....	2,000	3.99	1,997	4.96	3,904	9.86	23,600
29	.....	1,300	.....	1,100	.....	2,020	4.07	2,115	5.79	6,269	9.91	23,990
30	.....	1,340	.....	.....	.....	2,050	3.92	1,906	6.06	7,164	9.45	21,580
31	.....	1,370	.....	.....	.....	2,080	.....	.....	6.09	7,266	.....	.....

a Gauge height interpolated.
b Ice conditions, January 1 to April 10.
s Shifting conditions, June 27 to July 20.

DAILY GAUGE HEIGHT AND DISCHARGE of Bow river at Calgary, for 1916—*Concluded*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	8.97	19,815	6.14	7,436	6.17	7,538	5.02	4,052	4.42	2,718	4.20	2,440
2	8.91	19,680	6.20	7,640	6.24	7,792	4.98	3,952	4.43	2,737	4.22	2,460
3	9.27	21,447	6.28	7,944	6.35	8,210	5.62	5,742	4.36	2,608	4.19	2,420
4	9.36	21,986	6.32	8,096	7.64	13,412	4.82	3,576	4.37	2,626	4.15	2,175
5	9.16	21,165	6.24	7,792	7.47	12,694	4.78	3,484	4.37	2,626	4.20	2,020
6	8.57	19,095	6.11	7,334	7.17	11,434	4.82	3,576	4.35	2,590	4.19	1,750
7	8.31	17,565	6.06	7,164	6.88	10,252	4.78	3,484	4.37	2,626	4.08	1,460
8	8.38	18,015	6.03	7,062	6.58	9,084	4.72	3,346	4.26	2,432	4.15	1,450
9	8.77	19,905	6.35	8,210	6.33	8,134	4.68	3,256	4.28	2,466	4.24	1,460
10	8.94	20,805	6.56	9,008	6.27	7,906	4.67	3,234	4.32	2,536	4.15	1,460
11	8.96	20,985	6.45	8,590	6.10	7,300	4.65	3,190	4.08	2,130	4.12	1,490
12	8.73	19,770	6.28	7,944	5.97	6,861	4.62	3,124	3.66	1,572	4.18	1,535
13	8.60	19,005	6.08	7,232	6.02	7,028	4.60	3,080	3.58	1,480	4.31	1,610
14	8.58	18,780	6.03	7,062	5.96	6,828	4.62	3,124	3.60	1,500	4.58	1,655
15	8.34	17,430	5.95	6,795	5.87	6,531	4.61	3,102	4.39	2,662	4.42	1,650
16	7.86	15,180	6.03	7,062	5.76	6,176	4.62	3,124	4.38	2,644	4.55	1,625
17	7.81	14,820	6.08	7,232	5.66	5,866	4.66	3,212	4.34	2,572	4.63	1,670
18	8.13	16,080	7.96	14,820	5.58	5,618	4.66	3,212	4.23	2,381	4.67	1,700
19	8.15	15,990	7.47	12,694	5.50	5,370	4.86	3,668	4.32	2,536	4.71*a*	1,710
20	7.83	14,415*s*	6.92	10,408	5.47	5,277	4.85	3,645	4.28	2,466	4.75*a*	1,720
21	7.52	12,904	6.52	8,856	5.37	4,979	4.81	3,553	4.32	2,536	4.79*a*	1,740
22	7.27	11,854	6.36	8,248	5.27	4,709	4.76	3,438	4.41	2,699	4.84*a*	1,760
23	7.05	10,930	6.46	8,628	5.23	4,601	4.72	3,346	4.23	2,381	4.89	1,780
24	6.86	10,174	6.56	9,008	5.19	4,494	4.74	3,392	3.97	1,971	5.13	1,780
25	6.63	9,277	6.56	9,008	5.19	4,494	4.69	3,278	4.22*b*	2,350	4.87	1,625
26	6.60	9,160	6.51	8,818	5.19	4,494	4.64	3,168	4.23	2,420	5.11	1,175
27	6.61	9,199	6.39	8,362	5.02	4,052	4.64	3,168	4.24	2,440	4.31	745
28	6.52	8,856	6.28	7,944	5.03	4,078	4.60	3,080	4.27	2,490	4.62	1,080
29	6.41	8,438	6.24	7,792	5.03	4,078	4.52	2,912	4.21	2,480	5.09	1,625
30	6.24	7,792	6.18	7,572	5.03	4,078	4.49	2,851	4.14	2,440	4.97	1,655
31	6.16	7,504	6.14	7,436	.....	.....	4.50	2,870	.....	.....	4.90*b*	1,650

a Gauge height interpolated.
b Ice conditions, November 25 to December 31.
s Shifting conditions, June 27 to July 20.

MONTHLY DISCHARGE of Bow river at Calgary, for 1916

(Drainage area 3,136 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	1,370	730	1,116	0.356	0.41	68,620
February	1,390	1,100	1,284	0.409	0.44	73,856
March	2,080	1,065	1,558	0.497	0.57	95,798
April	2,230	1,724	2,028	0.647	0.72	120,674
May	7,266	2,100	3,330	1.062	1.22	204,750
June	27,078	6,828	14,702	4.688	5.23	874,830
July	21,986	7,504	15,420	4.917	5.67	948,139
August	14,820	6,795	8,359	2.665	3.07	513,975
September	13,412	4,052	6,778	2.161	2.41	403,319
October	5,742	2,851	3,395	1.083	1.25	208,750
November	2,737	1,480	2,404	0.767	0.86	143,048
December	2,460	745	1,680	0.536	0.62	103,300
The year	.....	.....	.....	.....	22.47	3,759,059

MEAN MONTHLY DISCHARGE in Second-feet of Bow river at Calgary

MONTH	1907–8	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
Oct.	.....	*b*2,400	2,423	3,094	2,424	3,064	2,635	2,772	2,680	3,395	2,811	173,080
Nov.	.....	.....	*d*1,880	*f*1,205	1,609	2,076	1,951	1,767	1,746	2,404	1,926	114,584
Dec.	.....	.....	.....	1,205	774	985	1,794	1,111	1,269	1,680	1,260	77,457
Jan.	.....	.....	.....	*g*880	1,109	1,118	1,054	1,225	1,116	.....	1,124	69,137
Feb.	.....	.....	.....	914	1,048	1,124	945	1,197	1,284	.....	1,085	61,048
Mar.	.....	.....	.....	857	1,030	1,192	1,034	1,400	1,558	.....	1,178	72,463
April	.....	*c*1,354	*e*1,952	1,292	1,571	1,663	1,498	1,605	2,028	.....	1,610	95,772
May	*a*5,955	4,176	6,683	2,676	3,432	3,201	3,700	4,459	3,330	.....	3,957	243,316
June	13,702	14,527	10,427	11,434	8,185	11,557	10,208	10,440	14,702	.....	11,687	695,410
July	10,801	12,263	7,961	9,459	10,772	7,651	9,645	14,470	15,420	.....	10,938	672,559
Aug.	5,652	5,879	5,279	7,396	8,169	6,825	4,750	8,305	8,359	.....	6,735	414,058
Sept.	3,648	3,703	3,441	4,452	4,847	4,561	2,926	4,115	6,778	.....	4,275	254,353
Total in acre-feet	2,303,927	2,619,924	2,313,943	2,623,802	2,728,834	2,721,974	2,552,537	3,207,923	3,650,670	.....	.....	2,943,237

a 10-31.
b 1-28.
c 20-30.
d 1-6.
e 6-30.
f 29-30.
g 1-4 and 21-30.

ELBOW RIVER AT FULLERTON'S RANCH

Location.—On the NW. ¼ Sec. 12, Tp. 23, Rge. 5, W. 5th Mer., at E. R. Fullerton's ranch, thirty-five miles southwest of Calgary.

Records available.—September 29,1914, to December 31, 1916.

Gauge.—Vertical staff on right bank; zero elevation maintained at 90.33 feet during 1914 and January 1915. Standard chain on log traffic bridge about 300 feet down stream from staff; zero elevation maintained at 85.40 feet during 1914 and from January 1 to June 26, 1915. Vertical staff on left bank opposite staff on right bank; zero elevation maintained at 90.83 feet from July 20, 1915, to December 31, 1916.

Bench-mark.—Permanent iron bench-mark, on left bank near staff; assumed elevation 100.00 feet.

Channel.—Boulders, fairly permanent.

Discharge measurements.—Made by wading or from bridge.

Floods.—Bridge and all gauges carried away on June 26, 1915, and June 16, 1916.

Observer.—E. R. Fullerton.

Remarks.—No discharge measurements were obtained between May 27, 1916, and September 19, 1916, as the bridge has been washed away and this stream remained too high to wade during the summer. A cable station has now been erected and will be used in 1917.

DISCHARGE MEASUREMENTS of Elbow river at Fullerton's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq.-ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 7	F. K. Beach	118	234	0.51	3.06	118
Feb. 3	H. C. Ritchie	60	33	1.35	3.14	45
Mar. 10	do	60	45	1.62	3.70	73
Mar. 23	do	100	95	2.08	1.09	197
April 10	do	90	101	3.23	1.29	291*n*
May 5	do	113	151	3.12	1.54	470
May 26	do	112	136	2.73	1.45	372
Sept. 19	do	105	151	3.94	1.03	594
Oct. 17	do	102	132	3.56	0.86	470
Nov. 7	do	100	104	2.98	0.71	309
Nov. 28	do	94	90	2.70	0.61	242
Dec. 18	W. K. Broughton	107	142	2.14	2.07	303

n Discharge was measured at a miscellaneous section 6 miles below gauge.

DAILY GAUGE HEIGHT AND DISCHARGE of Elbow river at Fullerton's ranch, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.80[b]	104	3.33	46	1.97	114	1.09	202	1.36	328	1.88	.....
2	2.80	105	3.23	45	1.77	105	1.09	202	1.48	390	2.05	.....
3	2.70	107	3.24	45	1.77	90	1.09	202	1.58	442	2.58	.....
4	2.70	111	3.24	45	1.67	75	1.11	210	1.63	468	2.68	.....
5	3.01	115	3.22	45	1.57	65	1.34	318	1.57	436	2.63	.....
6	2.91	116	3.19	47	1.72	66	1.38	338	1.54	421	2.53	.....
7	3.06	118	3.14	50	2.67	68	1.39	343	1.54	421	2.71	.....
8	3.11	117	3.14	55	2.62	70	1.37	333	1.52	410	2.68	.....
9	3.07	112	3.14	60	3.17	72	1.34	318	1.55	426	2.58	.....
10	2.92	109	3.14	66	3.70	73	1.29	293	1.55	426	2.63	.....
11	3.02	108	3.19	75	4.01	74	1.27	284	1.42	358	2.48	.....
12	3.07	108	3.30	85	3.42	81	1.18	241	1.42	358	2.38	.....
13	3.08	103	3.43	95	3.17	86	1.18	241	1.40	348	2.51	.....
14	3.73	98	3.45	102	2.72	95	1.18	241	1.38	338	2.68	.....
15	3.53	93	3.55	110	2.67	106	1.20	250	1.37	333	2.93	.....
16	3.73	89	3.78	120	2.17	118	1.18	241	1.36	328	3.18	.....
17	3.54	82	3.55	135	1.72	131	1.18	241	1.36	328	4.16	.....
18	3.54	77	3.80	148	1.61	144	1.23	264	1.35	323	2.63	.....
19	3.54	73	3.40	155	1.56	156	1.21	255	1.35	323	2.78	.....
20	3.54	68	2.80	156	1.45	167	1.23	264	1.35	323	2.13	.....
21	3.46	65	2.81	157	1.35[b]	178	1.24	269	1.36	328	2.73	.....
22	3.45	63	2.81	155	1.10	206	1.28	288	1.37	333	2.33	.....
23	3.44	60	2.56	151	1.09	202	1.28	288	1.42	358	2.28	.....
24	3.38	58	2.56	145	1.07	195	1.28	288	1.47	384	2.18	.....
25	3.36	56	2.44	141	1.04	184	1.26	279	1.48	390	2.08	.....
26	3.46	54	2.38	137	1.04	184	1.31	303	1.53	416	2.33	.....
27	3.49	52	2.38	131	1.04	184	1.38	338	1.73	.....	3.13	.....
28	3.52	50	2.16	126	1.04	184	1.36	328	2.05	.....	2.98	.....
29	3.47	49	1.96	121	1.04	184	1.33	313	1.93	.....	2.78	.....
30	3.37	48	.....	.....	1.06	192	1.31	303	1.85	.....	2.58	.....
31	3.37	47	.....	.....	1.07	195	.....	.....	1.88	.....	.....	.....

b Ice conditions, January 1 to March 21

DAILY GAUGE HEIGHT AND DISCHARGE of Elbow river at Fullerton's ranch, for 1916—*Concluded*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.23		0.99		1.21		0.84	465	0.86	474	0.98	231
2	2.93		0.99		1.18		0.82	455	0.86	474	1.28	224
3	2.73		1.01		1.58		0.82	455	0.86	474	0.98	219
4	2.38		1.03		2.38		0.82	455	0.86	474	0.93	215
5	2.08		1.01		2.23		0.84	465	0.85	469	0.83	208
6	1.98		0.99		2.03		0.84	465	0.80*b*	380	0.83	204
7	1.93		0.98		2.01		0.84	465	0.71	309	0.83	202
8	1.91		0.96		2.48		0.87	480	0.70	308	0.84	202
9	1.83		1.53		2.38		0.86	474	0.70	307	0.84	205
10	1.76		1.43		2.38		0.86	474	0.70	305	0.99	208
11	1.71		1.35		2.13		0.86	474	0.70	304	1.04	209
12	1.63		1.23		2.05		0.85	469	0.70	302	1.04	211
13	1.61		1.11		1.57		0.85	469	0.69	300	1.14	215
14	1.58		1.08		1.31		0.85	469	0.69	298	1.29	222
15	1.53		1.03		1.23		0.85	469	0.69	295	1.39	235
16	1.43		1.00		1.13		0.85	469	0.69	293	1.49	254
17	1.38		0.98		1.08		0.88	484	0.68	291	1.80	280
18	1.33		2.38		1.08		0.86	474	0.68	287	2.07	303
19	1.31		2.35		1.03	561	0.86	474	0.68	284	2.19	309
20	1.28		1.93		1.03	561	0.86	474	0.67	280	2.15	300
21	1.23		1.98		1.01	550	0.86	474	0.67	276	2.06	260
22	1.22		1.98		0.98	535	0.87	480	0.66	273	2.11	200
23	1.18		2.03		0.98	535	0.87	480	0.66	269	2.11	180
24	1.13		1.98		0.98	535	0.87	480	0.65	265	2.17	174
25	1.11		1.83		0.96	525	0.86	474	0.64	260	2.27	169
26	1.07		1.63		0.93	509	0.85	469	0.64	253	2.57	166
27	1.03		1.53		0.91	499	0.86	474	0.62	246	2.33	162
28	1.03		1.43		0.88	484	0.86	474	0.61	242	2.68	160
29	1.02		1.35		0.87	480	0.86	474	0.65	239	3.33	158
30	1.01		1.28		0.83	460	0.85	469	0.88	235	3.49	160
31	1.00		1.24				0.85	469			3.59*b*	175

b Ice conditions, November 6 to December 31.

MONTHLY DISCHARGE of Elbow river at Fullerton's ranch, for 1916

(Drainage area 254 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-ft.
January	118	47	84	0.331	0.38	5,165
February	157	45	102	0.402	0.43	5,867
March	206	65	130	0.511	0.59	7,993
April	343	202	276	1.087	1.21	16,423
May (1-26)	468	323	374	1.472	1.42	19,287
June						
July						
August						
September (19-30)	561	460	520	2.047	0.91	12,377
October	484	455	471	1.854	2.14	28,960
November	474	235	316	1.244	1.39	18,803
December	309	158	214	0.843	0.97	13,158
The period					9.44	128,033

ELBOW RIVER AT CALGARY

Location.—On the SW. ¼ Sec. 14, Tp. 24, Rge. 1, W. 5th Mer., city corporation yard, at foot of Thirteenth avenue east, Calgary.

Records available.—May 8, 1908, to December 31, 1916.

Gauges.—Standard chain on Twelfth avenue bridge; elevation of zero maintained at 3,404.82 feet during 1915-16. Vertical staff at metering section 700 feet up stream from bridge; elevation of zero maintained at 3,406.95 during 1915-16.

Bench-marks.—(1) Permanent iron bench-mark on left bank near cable station; elevation 3,423.85 feet above mean sea-level. (Geodetic Surveys of Canada.) (2) Permanent bench-mark on corner of Twelfth avenue east; elevation 3,420.07 feet above mean sea-level. (Geodetic Surveys of Canada.)

Channel.—Composed of coarse gravel and boulders, liable to shift and affected by backwater from the Bow river during flood stages of that stream.

Discharge measurements.—Made from a cable car, or in low water by wading.

Observers.—Mrs. I. S. White and John Nicol.

Accuracy.—Gauge heights were read to one-hundredth of a foot at a time of mean daily gauge height.

There were two curves used during the open water season: one for chain gauge readings up to May 2, and the other for staff gauge from May 2 to the end of the season.

Both curves pass through nine points out of fourteen measurements, three points plot very close to the curve and two had no bearing on the curve, as the gauge heights were affected by back water from the Bow river in its high stage.

The curve is regular and well defined and the daily discharges are satisfactory and well within the limit of error.

Ice conditions obtained from January 1 to April 10, and from November 10 to December 31, during which period discharges were based upon daily gauge heights, discharge measurements and temperature graphs, and are fairly close estimates.

DISCHARGE MEASUREMENTS of Elbow river at Calgary, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 26	O. H. Hoover	70	109	1.01	3.37*x*	110
Feb. 28	S. H. Frame	55	75	2.73	2.36*x*	204
Mar. 20	E. J. Switzer	90	104	2.77	4.28*x*	288
April 7	O. H. Hoover	132	315	1.70	2.41*x*	534
May 2	W. K. Broughton	143	271	1.36	1.68	370
May 26	do	141	327	2.04	2.24	668
June 7	do	148	569	3.92	3.70	2,224
June 17	A. B. Cook	148	732	5.37	4.97	3,933
June 21	W. K. Broughton	143	809	4.84	5.67*c*	3,912
June 27	do	141	655	4.35	4.46*c*	2,850
June 29	R. J. McGuinness	143	885	5.82	5.67	5,150
July 20	W. K. Broughton	132	334	2.80	2.52	936
Aug. 1	do	141	316	1.74	2.04	548
Aug. 21	do	148	505	3.52	3.51	1,780
Sept. 16	do	144	357	2.12	2.42	759
Oct. 3	do	142	314	1.62	2.01	501
Nov. 1	do	141	300	1.50	1.89	449
Nov. 17	do	140	286	1.18	1.82	337
Dec. 8	do	138	229	0.76	1.65*x*	175
Dec. 28	C. M. O'Neill	92	92	1.06	1.41*x*	98

c Gauge height affected by backwater from Bow river.
x Chain gauge.

Daily Gauge Height and Discharge of Elbow river at Calgary, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.72*bc*	66	3.16	114	2.53	201	2.38	523	1.92*c*	367	3.97	2,430
2	4.03	97	3.16	116	2.64	200	2.97	790	1.67*s*	367	3.72	2,105
3	4.24	107	3.16	117	2.75	199	2.72	669	1.85	438	3.85	2,270
4	3.96	109	3.20	118	2.91	198	2.42	538	2.03	537	4.07	2,564
5	3.85	105	3.29	119	3.11	197	2.20	460	1.98	506	4.33	2,929
6	3.60	96	3.23	120	2.77	197	2.31	499	1.91	466	3.98	2,443
7	3.85	108	3.23	121	2.62	198	2.40	530	1.85	438	3.72	2,105
8	3.64	111	3.37	122	2.47	200	2.37	520	1.83	429	3.94	2,389
9	3.56	107	3.34	123	2.35	201	2.25	478	1.75	397	3.95	2,403
10	3.37	103	3.33	124	2.87	203	2.20	460	1.73	389	4.02	2,497
11	3.34	98	3.31	126	5.21	206	2.19	457	1.71	382	3.64	2,008
12	3.31	91	3.28	128	6.64	212	2.17	450	1.66	364	3.52	1,868
13	3.36	94	3.30	134	5.70	223	2.16	446	1.61	346	3.50	1,845
14	3.38	100	3.34	154	5.09	242	2.22	467	1.57	333	3.62	1,989
15	3.36	107	3.42	174	4.72	262	2.30	495	1.58	336	3.93	2,375
16	3.28	113	4.01	189	4.53	280	2.13	436	1.61	346	5.20	4,320
17	3.26	116	4.04	199	4.31	289	2.07	415	1.63	353	4.97	3,929
18	3.25	118	3.36	206	4.15	295	2.00	393	1.61	346	5.12	4,184
19	3.23	120	4.00	210	4.19	294	2.02	400	1.68	371	5.22	4,354
20	3.24	120	3.78*a*	211	4.27	288	2.03	403	1.73	389	4.87	3,760
21	3.24	118	3.57	212	4.73	286	1.95	376	1.75	397	4.96*a*	3,912
22	3.33	117	3.42	212	5.11	287	1.95	376	1.84	434	4.48	3,150
23	3.34	115	3.25	211	3.97	292	1.95	376	1.82	425	3.94	2,389
24	3.36	114	3.07	210	2.94	300	1.94	373	2.06	555	3.67	2,044
25	3.34*a*	112	2.91	208	2.32	314	1.96	380	2.12	593	3.40	1,730
26	3.31*a*	110	2.70	206	2.28	327	1.93	370	2.24	673	3.58	1,937
27	3.28*a*	110	2.45	205	2.13	340	1.93	370	2.28	701	4.27*a*	2,843
28	3.25*a*	112	2.36	204	1.97	360	1.92	367	2.56	905	4.78	3,613
29	3.22*a*	112	2.42	203	1.87	382	1.92	367	3.72	2,105	5.67	5,141
30	3.19	113	.....	.....	1.91	420	1.92	367	4.61	3,346	4.33*s*	2,929
31	3.16	114	.....	.....	1.95*b*	440	.....	.....	3.91	2,349	.....	.....

b Ice conditions, January 1 to March 31.
a Gauge height interpolated.
c Chain gauge, January 1 to May 1. *s* Staff gauge, May 2 to June 30.

DAILY GAUGE HEIGHT AND DISCHARGE of Elbow river at Calgary, for 1916—*Concluded*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.97*s*	2,430	2.04	543	2.39	778	1.98	506	1.90	460	2.05	239
2	3.94	2,389	2.00	518	2.33	736	1.97	501	1.89	456	2.05	238
3	4.10	2,605	2.02	530	2.29	708	2.01	524	1.88	451	2.09	235
4	4.64	3,392	1.99	512	4.44	3,090	2.01	524	1.87	447	2.07	224
5	3.96	2,416	2.04	543	4.52	3,210	2.03	537	1.86	443	1.95	213
6	3.59	1,948	2.02	530	3.80	2,205	2.03	537	1.85	438	1.95	200
7	3.42	1,753	2.00	518	3.44	1,776	2.03	537	1.82	425	1.91	187
8	3.49	1,833	1.98	506	3.02	1,320	2.02	530	1.77	405	1.90	175
9	3.54	1,891	2.37	764	2.90	1,200	2.02	530	1.74	393	1.90	172
10	3.47	1,811	2.83	1,133	2.83	1,133	2.01	524	1.77*s*	405	1.82	169
11	3.32	1,638	2.73	1,042	2.79	1,096	2.00	518	2.11*bc*	335	1.80	167
12	3.13	1,432	2.38	771	2.69	1,007	1.99	512	2.16	336	2.01	215
13	3.05	1,350	2.23	666	2.65	975	1.97	501	2.04	335	1.79	195
14	2.98	1,280	2.18	632	2.56	905	1.94	483	2.09	333	1.72	184
15	2.76	1,069	2.15	612	2.48	845	1.94	483	2.06	333	1.98	213
16	2.54	890	2.10	580	2.39	778	1.93	477	2.10	335	1.97	213
17	2.77	1,078	2.08	568	2.35	750	1.94	483	2.14	337	1.72	183
18	2.80	1,105	2.78	1,087	2.31	722	1.99	512	2.14*a*	334	1.66	191
19	2.75	1,060	4.18	2,717	2.28	701	2.09	574	2.15*a*	333	1.90	199
20	2.52	875	3.93	2,375	2.24	673	2.10	580	2.16*a*	332	1.89	196
21	2.48	845	3.51	1,857	2.20	645	2.07	561	2.16*a*	326	1.69	183
22	2.35	750	3.39	1,718	2.15	612	2.03	537	2.17*a*	322	1.63	179
23	2.28	701	3.65	2,020	2.12	593	2.00	518	2.18*a*	317	1.60	175
24	2.25	680	3.49	1,833	2.08	568	1.98	506	2.19	310	1.68	167
25	2.36	757	3.22	1,527	2.05	549	1.97	501	2.10	300	1.69	157
26	2.40	785	2.94	1,240	2.04	543	1.97	501	1.96	287	1.47	155
27	2.45	823	2.83	1,133	2.01	524	1.97	501	1.95	268	1.45	130
28	2.31	722	2.73	1,042	1.99	512	1.97	501	1.95	256	1.32	98
29	2.19	639	2.59	927	1.98	506	1.95	489	1.95	247	1.38	100
30	2.01	524	2.52	875	1.97	501	1.94	483	1.94	240	1.37	102
31	1.95	489	2.44	815	.....	.....	1.91	466	.....	.....	1.36*bc*	105

a Gauge height interpolated.
b Ice conditions, November 11 to December 31.
s Staff gauge used July 1 to November 10. *c* Chain gauge, November 11 to December 31.

MONTHLY DISCHARGE of Elbow river at Calgary, for 1916

(Drainage area 466 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	120	66	108	0.232	0.27	6,641
February	212	114	165	0.354	0.38	9,491
March	440	197	269	0.577	0.67	16,540
April	790	367	452	0.970	1.08	26,896
May	3,346	333	658	1.412	1.63	40,459
June	5,141	1,730	2,815	6.041	6.74	167,505
July	3,392	489	1,354	2.906	3.35	83,254
August	2,717	506	1,037	2.225	2.56	63,763
September	3,210	501	1,005	2.157	2.41	59,802
October	580	466	514	1.103	1.27	31,605
November	460	240	351	0.753	0.84	20,886
December	239	98	179	0.384	0.44	11,006
The year	.....	.....	.....	.....	21.64	537,848

MEAN MONTHLY DISCHARGE in Second-feet of Elbow river at Calgary

MONTH	1907–8	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
Oct.		245	231	292	367	332	247	336	558	514	347	21,329
Nov.		*b*236		206	212	150	230	174	299	351	232	13,769
Dec.				119	100	118	138	121	186	179	137	8,439
Jan.				62	106	93	115	126	108		102	6,252
Feb.				96	120	126	110	105	165		120	6,778
Mar.				141	129	107	113	157	269		153	9,391
April.			101	236	263	406	255	218	452		276	16,415
May	*a*694	968	309	407	461	538	396	1,198	658		617	37,926
June	2,266	1,377	466	915	937	695	691	2,127	2,815		1,365	81,251
July	700	930	282	633	1,589	476	453	1,930	1,354		927	56,972
Aug.	333	431	288	982	554	559	255	907	1,037		594	36,518
Sept.	281	256	422	700	403	320	199	656	1,005		471	28,042
Total in acre-feet.	248,113	261,009	127,055	289,765	317,776	237,029	193,500	488,359	537,890			323,082

a 8-31.
b 1-12.

NOSE CREEK AT CALGARY

Location.—On the SW. ¼ Sec. 35, Tp. 24, Rge. 1, W. 5th Mer., about one-quarter mile west of Canadian Pacific railway, Calgary-Edmonton branch, and at bridge on 36th avenue north, city of Calgary.

Records available.—April 24, 1911, to November 18, 1916.

Gauge.—Vertical staff; fastened to a pile of the bridge, near right bank; elevation of zero maintained at 90.60 feet from May 3, 1916, to November 18, 1916. Elevation of zero at old station was maintained at 92.81 feet from establishment on April 24, 1911, to May 2, 1916.

Bench-mark.—Permanent iron bench-mark, fifteen feet southwest of bridge; assumed elevation 100.00 feet.

Channel.—Fairly permanent.

Discharge measurements.—Made from a bridge or by wading.

Observers.—C. A. Lang and J. Haigh.

Remarks.—Previous to May 3, 1916, the station on Nose creek was situated on the NW. ¼ Sec. 13, Tp. 24, Rge. 1, W. 5th Mer., near the confluence of the creek with the Bow river, and was transferred to its present location on May 3, 1916.

DISCHARGE MEASUREMENTS of Nose creek at Calgary, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 10	O. H. Hoover	24	55	1.64	2.47	90*x*
May 3	W. K. Broughton	30	45	1.33	2.53	61
May 26	do	36	76	2.20	3.54	168
June 1	do	52	174	4.09	5.82	712
July 6	do	42	131	3.64	5.01	477
Aug. 2	do	29	46	1.35	2.69	62
Aug. 10	do	34	66	2.29	3.39	150
Aug. 19	do	49	205	4.16	6.48	852
Sept. 6	do	45	164	4.03	5.61	660
Oct. 4	do	34	68	1.97	3.21	134
Nov. 2	do	35	85	1.09	3.04	93

x Measurement at old station. New station established May 3.

DAILY GAUGE HEIGHT AND DISCHARGE of Nose creek at Calgary, for 1916

DAY	February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			3.00*a*		2.72	137	2.01*a*	53	5.82	688
2			3.04*a*		3.17	269	2.06*a*	56	5.04*a*	493
3			3.18*a*		3.12	251	2.53	61	4.42	342
4			3.35*a*		3.12	251	2.47	57	3.89	226
5			3.45*a*		3.12	251	2.38	52	3.88	225
6			3.53*a*		2.72	137	2.36	51	3.89	226
7			3.58*a*		2.66	124	2.27	46	3.56	172
8			3.65*a*		2.51	98	2.20	43	3.35	144
9			3.77*a*		2.46	91	2.18	42	3.22	127
10			3.88		2.46	91	2.16	41	3.28	135
11			4.03		2.36	80	2.18	42	3.29	136
12			4.03		2.26	71	2.21	44	3.17	121
13			3.81*a*		2.26	71	2.23	44	3.01	104
14			3.50*a*		2.21	67	2.22	44	2.93	96
15			3.40*a*		2.18	64	2.24	45	2.85	88
16			3.40*a*		2.16	63	2.24	45	2.78	81
17			3.50*a*		2.11*a*	59	2.23	44	2.73	77
18	4.39*b*		3.61*a*		2.09*a*	57	2.23	44	2.68	72
19	4.19		3.78*a*		2.01*a*	53	2.23	44	2.69	73
20	4.10*a*		3.88		1.96*a*	50	2.19	43	3.03	106
21	4.00*a*		4.18		1.93*a*	48	2.14	41	3.11	114
22	3.87*a*		3.93		1.87*a*	44	2.42	54	2.99	102
23	3.77*a*		3.72		1.81*a*	42	2.51	60	2.89	92
24	3.70*a*		3.47		1.79*a*	40	3.10	113	3.33	141
25	3.62		3.12		1.76*a*	39	3.72	197	3.35	144
26	3.58		3.02*a*		1.78*a*	40	3.57	174	3.09	112
27	3.50		2.92*b*		1.81*a*	42	3.51	165	4.39	335
28	3.34		2.72	137	1.95*a*	49	3.07	110	4.67	402
29	3.00*a*		2.72	137	2.03*a*	54	4.23	298	4.13	276
30			2.72	137	1.98*a*	51	5.37	576	3.87	223
31			2.72	137	2.05*a*	55	7.69	1,155		

a Gauge height interpolated.
b Ice conditions, February 18 to March 27.

DAILY GAUGE HEIGHT AND DISCHARGE of Nose creek at Calgary, for 1916—*Concluded*

DAY	July		August		September		October		November	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.41	151	2.73*a*	77	3.63	183	3.16	120	2.93	96
2	3.58	175	2.70	74	3.50	164	3.15	119	3.15*b*	93
3	4.03	254	2.73	77	3.64	184	3.27	133	3.01	.....
4	6.85	946	2.92	95	4.93	466	3.23	129	3.06	.....
5	6.09	756	2.85	88	6.28	803	3.27	133	3.08	.....
6	5.07	500	2.74	78	5.73	666	3.33	141	2.85	.....
7	4.92	463	2.68	72	5.13	516	3.34	142	2.74	.....
8	4.71	411	2.67	72	4.37	330	3.26	132	2.96	.....
9	4.43	344	3.09	112	4.16	282	3.17	121	3.04	.....
10	3.97	242	3.42	153	3.48	161	3.11	114	2.62	.....
11	3.59	177	3.08	111	3.43	154	3.09	112	2.89	.....
12	3.37	146	2.90	93	3.48	161	3.05	108	2.98	.....
13	3.15	119	2.84	87	3.70	194	3.03	106	2.84	.....
14	3.06	109	2.74	78	3.60	178	2.99	102	2.82	.....
15	2.98	101	2.66	71	3.42	153	2.99	102	2.83	.....
16	2.93	96	2.66	71	3.36	145	2.98	101	2.87	.....
17	2.95	98	2.74	78	3.28	135	3.05	108	2.93	.....
18	3.35	144	3.46	158	3.24	130	3.13	117	3.30*m*	.....
19	3.29	136	6.55	870	3.17	121	3.19	124	.....	.....
20	3.13	117	6.40	833	3.14	118	3.33	141	.....	.....
21	2.94	97	5.46	598	3.10	113	3.45	157	.....	.....
22	2.87	90	4.78	428	3.10	113	3.49	163	.....	.....
23	2.84	87	4.08	265	3.07	110	3.46	158	.....	.....
24	2.79	82	3.78	208	3.02	105	3.43	154	.....	.....
25	3.10	113	3.47	159	2.97	100	3.44	156	.....	.....
26	3.32	140	3.26	132	3.08	111	3.40	150	.....	.....
27	3.16	120	3.16	120	3.06	109	3.33	141	.....	.....
28	3.09	112	3.06	109	3.00	103	3.15	119	.....	.....
29	2.94	97	3.00	103	2.97	100	3.11	114	.....	.....
30	2.82	85	2.96	99	3.04	107	3.09	112	.....	.....
31	2.77	80	3.00	103	.....	.....	3.05	108	.....	.....

a Gauge height interpolated.
b Ice conditions, November 2-18.
m Observations discontinued for season on November 18.

MONTHLY DISCHARGE of Nose creek at Calgary, for 1916

(Drainage area 308 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (28-31)	137	137	137	0.445	0.07	1,087
April	269	39	90	0.292	0.34	5,534
May	1,155	41	125	0.406	0.47	7,686
June	688	72	189	0.614	0.68	11,246
July	946	80	213	0.692	0.80	13,097
August	870	71	183	0.594	0.68	11,252
September	803	100	210	1.007	1.12	12,496
October	163	102	127	0.412	0.48	7,809
November (1-2)	96	93	94	0.305	0.02	373
The period	.....	.....	.....	.....	4.66	70,580

MEAN MONTHLY DISCHARGE in Second-feet of Nose creek at Calgary

MONTH	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	7.4	32.0	10.8	10.3	108	127	49	3,029
November	.....	5.8*b*	17.5*d*	.....	.....	.....	94*h*	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	.....	.....	.....	.....
March	.....	78.0*c*	.....	.....	.....	137*g*	.....	.....	.....
April	12.4*a*	30.0	81.0*e*	.....	11.8	90	.....	44	2,670
May	21.0	37.0	56.0	9.9*f*	34.0	125	.....	55	3,360
June	30.0	17.5	44.0	15.5	140.0	189	.....	73	4,328
July	8.7	45.0	38.0	7.7	312.0	213	.....	104	6,401
August	14.4	28.0	18.3	4.4	344.0	183	.....	99	6,064
September	9.8	55.0	15.0	5.5	137.0	210	.....	72	4,289
Total in acre-feet	5,245	14,404	16,351	3,259	60,246	69,039	.....	.....	30,141

a 24-30.
b 1-15.
c 26-31.
d 1-15.
e 10-30.
f 7-31.
g 28-31.
h 1-2.

CANADIAN PACIFIC RAILWAY COMPANY CANAL AT OGDEN

Location.—On the NE. ¼ Sec. 21, Tp. 23, Rge. 29, W. 4th Mer., one-half mile south of Ogden post office and about six miles below the headgates of the main canal "A."

Records available.—May 1, 1911, to September 26, 1916, and at station two miles up stream from May 8, 1908, to October 9, 1910.

Gauge.—Vertical staff in wooden bay of C.P.R. automatic gauge cabin on left bank of canal at end of bridge No. 3. Elevation of zero maintained at 86.65 feet during 1915-1916.

Bench-mark.—An iron post in left bank and two feet from lower end of left abutment of wooden traffic bridge about one hundred feet down stream from section. Assumed elevation 100.00 feet.

Channel.—Fairly permanent.

Discharge measurements.—Made from bridge.

Co-operation.—Gauge heights supplied by Canadian Pacific Railway Company.

DISCHARGE MEASUREMENTS of Canadian Pacific Railway Company canal at Ogden, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
May 3	W. K. Broughton	53.0	99.8	1.58	1.69	158
May 23	do	55.0	117.5	1.60	1.93	188
July 3	do	58.5	155.7	1.71	2.61	266
July 28	do	59.5	163.3	1.70	2.67	278
Aug. 24	do	62.0	221.0	1.81	3.54	399
Sept. 22	do	56.5	139.4	1.43	2.27	200

DAILY GAUGE HEIGHT AND DISCHARGE of Canadian Pacific Railway Company canal at Ogden, for 1916

DAY	April		May		June		July		August		September	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	1.51	119	1.01	69	2.68	278	2.02	179	2.74	287
2	.....	.....	1.58	127	1.01	69	2.79	296	2.06	184	2.57	261
3	.....	.....	1.97	172	1.01	69	1.96	171	2.16	198	2.46	244
4	.....	.....	1.84	157	1.00	68	Dry	Nil	2.17	200	2.10	190
5	.....	.....	1.91	165	1.00	68	"	"	2.18	201	1.25	92
6	.....	.....	2.17	200	Dry	Nil	"	"	2.00	176	1.63	132
7	.....	.....	2.06	184	"	"	1.58	127	2.02	179	1.56	125
8	.....	.....	2.16	198	"	"	1.96	171	2.03	180	1.51	119
9	.....	.....	2.13	194	"	"	1.88	162	2.08	187	1.90	164
10	.....	.....	2.09	189	0.63	41	1.97	172	2.13	194	2.13	194
11	.....	.....	2.15	197	0.89	59	2.48	247	2.14	196	2.70	281
12	.....	.....	2.08	187	1.01	69	2.49	249	2.10	190	2.64	271
13	.....	.....	2.07	186	1.17	84	2.47	245	2.07	186	2.18	201
14	.....	.....	2.08	187	1.14	81	2.45	242	2.04	182	2.15	197
15	.....	.....	2.08	187	1.17	84	2.26	212	2.02	179	2.12	193
16	0.85	56	2.08	187	1.46	114	1.85	158	2.01	177	2.10	190
17	0.93	62	2.08	187	1.45	112	1.42	109	2.03	180	2.07	186
18	1.07	75	2.12	193	1.23	90	1.34	101	2.09	189	2.13	194
19	1.13	80	2.09	189	1.41	108	1.31	98	1.98	173	2.14	196
20	1.27	94	2.07	186	1.44	111	1.49	117	1.79	151	2.19	203
21	1.27	94	2.11	192	1.46	114	1.58	127	2.16	198	2.18	201
22	1.32	99	2.11	192	0.68	45	1.65	135	2.16	198	2.14	196
23	1.58	127	2.13	194	0.80	53	1.44	111	2.27	214	2.12	193
24	1.65	135	2.18	201	1.83	156	1.42	109	3.28	384	2.11	191
25	1.62	131	2.05	183	1.59	128	1.64	133	2.04	182	2.07	186
26	1.72	142	1.95	170	0.72	47	2.25	211	2.06	184	1.06	73
27	1.60	129	2.06	184	Dry	Nil	2.11	192	2.04	182	.....	.....
28	1.60	129	2.11	191	1.14	81	1.87	160	2.09	189	.....	.....
29	1.60	129	2.02	179	1.14	81	1.75	146	2.09	189	.....	.....
30	1.60	129	1.83	156	1.26	93	1.96	171	2.09	189	.....	.....
31	.....	.....	1.53	121	.....	.....	1.96	171	2.30	218	.....	.....

MONTHLY DISCHARGE of Canadian Pacific Railway Company canal at Ogden, for 1916

MONTH	DISCHARGE IN SECOND-FEET			Total Discharge in Acre-feet
	Maximum	Minimum	Mean	
April (16-30)	135	56	107	3,184
May	201	119	179	11 006
June	156	Nil	70	4,165
July	296	"	156	9,592
August	384	151	194	11,929
September (1-26)	287	73	191	9,850
The period	.....	.....	.....	49,726

MEAN MONTHLY DISCHARGE in Second-feet of Canadian Pacific Railway Company canal at Ogden

MONTH	1909-10	1910-11	1911-12	1912-13	1913-14	1914-15	1915-16	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	222*b*	.....	.....	22*h*	.....	.....	.....	.....
November	.....	.....	.....	.....	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	.....	.....	.....	.....
March	.....	.....	.....	.....	.....	.....	.....	.....	.....
April	192*a*	39*c*	140*e*	249*g*	143*i*	.....	107*k*	.....	.....
May	184	150	138	238	186	239	179	188	11,545
June	228	256	229	194	457	249	70	240	14,308
July	552	269	179	229	271	351	156	287	17,626
August	367	144	189	123	361	159	194	220	13,498
September	221	230*d*	210*f*	283	313	152*j*	191*l*	272	15,840
Total in acre-feet	94,950	67,097	58,625	67,131	99,562	69,312	49,726	.....	72,817

a 27-30.
b 1-10.
c April 30.
d 1-28.
e 23-30.
f 1-28.
g 26-30.
h 1.
i 19-30.
j 1-28.
k 16-30.
l 1-26.

1910. Records obtained at Head-gates.
1911-13. " " " Ogden.
1914—Up to July 1 and after Sept. 21. " " " Head-gates.
1914—July 1 to Sept. 21. " " " Ogden.
1915-16. " " " Ogden

FISH CREEK NEAR PRIDDIS

Location.—On S.W. ¼ Sec. 26, Tp. 22, Rge. 3, W. 5th Mer., at the Percival ranch which is about one mile north of Priddis post office.

Records available.—May 13, 1907, to October 31, 1916.

Gauge.—Vertical staff, replaced by chain gauge, August 25, 1916. Zero elevation maintained at 91.24 feet during 1907-10. Zero elevation maintained at 90.81 feet during 1911-16.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—Not liable to shift except in extreme high water.

Discharge measurements.—By wading or from traffic bridge, about one mile up stream or from cable suspension bridge at the station.

Winter flow.—Observations discontinued during winter months.

Floods.—The largest recorded discharge at this station took place June 26, 1915, when the water elevation was 98.81 feet with an estimated flow of 7,056 sec.-ft.

Observer.—Fred Percival.

DISCHARGE MEASUREMENTS of Fish creek near Priddis, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. Feet*	*Ft. per sec.*	*Feet*	*Sec.-Feet*
April 6	J. M. Paul	66	93.6	1.87	5.23	175
May 5	W. M. Edwards	45	39.5	1.64	2.22	65
June 22	R. J. McGuinness	53	135.0	1.40	2.92	189
July 27	W. M. Edwards	43	38.2	1.58	2.15	60
Aug. 25	do	52	125.0	1.03	2.62	128
Oct. 25	W. H. Hannan	51	111.0	0.83	2.47	91

DAILY GAUGE HEIGHT AND DISCHARGE of Fish creek near Priddis, for 1916

DAY	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	4.94	1,396	2.38	82	5.31	1,771
2	.....	.....	5.80	2,350	2.42	88	5.00	1,450
3	.....	.....	5.39	1,859	2.42	88	6.06	2,710
4	.....	.....	5.43	1,903	2.46	94	6.98	4,272
5	.....	.....	5.46	1,936	2.30	71	5.11	1,560
6	.....	.....	5.22	1,672	2.47	96	5.06	1,510
7	.....	.....	5.21	1,661	2.11	50	4.31	877
8	.....	.....	5.21	1,661	2.11	50	4.14	758
9	.....	.....	4.59	1,092	2.10	49	4.02	682
10	.....	.....	4.40	940	2.10	49	3.99	664
11	.....	.....	4.10	730	2.08	47	3.68	490
12	6.54	3,468	3.20	280	2.08	47	3.34	336
13	6.90	4,120	3.00	220	2.08	47	3.32	328
14	6.90	4,120	3.00	220	2.08	47	3.20	280
15	6.71	3,768	3.20	280	1.98	37	3.11	253
16	6.56	3,502	3.20	280	2.06	45	3.08	244
17	6.56	3,502	3.20	280	2.11	50	3.02	226
18	6.44	3,304	3.10	250	2.11	50	2.92	196
19	6.41	3,256	2.78	157	2.10	49	2.71	141
20	6.33	3,128	2.76	153	2.10	49	2.74	148
21	6.27	3,032	2.76	153	2.08	47	3.16	268
22	6.27	3,032	2.58	115	2.15	54	3.01	223
23	5.78	2,324	2.58	115	2.35	78	3.11	253
24	5.74	2,272	2.47	96	3.06	238	2.56	111
25	5.62	2,124	2.47	96	3.06	238	2.65	129
26	5.51	1,992	2.44	91	3.34	336	4.02	682
27	5.48	1,958	2.44	91	3.35	340	5.08	1,530
28	5.48	1,958	2.38	82	3.37	348	5.58	2,076
29	5.22	1,672	2.38	82	3.60	450	4.16	772
30	4.98	1,432	2.38	82	3.71	505	3.18	274
31	4.96	1,414	.....	.....	4.74	1,216	.....	.....

DAILY GAUGE HEIGHT AND DISCHARGE of Fish creek near Priddis, for 1916—*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.18	274	1.99	38	2.60	119	2.14	53
2	3.46	384	1.81	24	2.57	113	2.24	64
3	3.38	352	1.80	23	2.56	111	2.22	61
4	4.25	835	1.84	26	4.21	807	2.20	59
5	4.08	718	2.22	61	5.60	2,100	2.18	57
6	3.07	241	2.22	61	5.60	2,100	2.46	94
7	3.04	232	2.12	51	3.20	280	2.49	98
8	2.87	182	2.10	49	3.64	470	2.47	96
9	2.80	162	2.72	144	3.66	480	2.36	79
10	2.69	137	3.07	241	3.61	455	2.43	90
11	2.67	133	2.64	127	2.04	43	2.47	96
12	2.47	96	2.52	104	2.84	173	2.46	94
13	2.45	92	2.08	47	3.00	220	2.40	85
14	2.43	90	2.04	43	2.13	52	2.42	88
15	2.42	88	1.80	23	2.22	61	2.31	72
16	2.21	60	1.82	25	2.23	63	2.29	70
17	2.21	60	1.82	25	2.49	98	2.26	66
18	2.19	58	2.98	214	2.46	94	2.32	74
19	2.18	57	6.04	2,680	2.35	78	2.34	77
20	2.17	56	4.43	964	2.30	71	2.33	75
21	2.09	48	3.75	525	2.28	69	2.39	84
22	2.04	43	3.24	296	2.20	59	2.42	88
23	2.04	43	3.08	244	2.17	56	2.42	88
24	2.00	39	2.82	168	2.06	45	2.42	88
25	2.14	53	2.62	123	2.13	52	2.43	90
26	2.20	59	2.31	72	2.04	43	2.51	102
27	2.15	54	2.37	81	2.04	43	2.49	98
28	2.15	54	2.46	94	2.02	41	2.21	60
29	2.00	39	2.57	113	2.10	49	2.41	86
30	2.00	39	2.56	111	2.09	48	2.09	48
31	2.00	39	2.56	111			2.23	63

MONTHLY DISCHARGE of Fish creek near Priddis, for 1916

(Drainage area 109 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (12-31)	4,120	1,414	2,769	25.400	18.89	109,818
April	2,350	82	677	6.210	6.93	40,284
May	1,216	37	162	1.490	1.72	9,961
June	4,272	111	840	7.700	8.59	49,983
July	835	39	155	1.420	1.64	9,531
August	2,680	23	222	2.040	2.35	13,650
September	2,100	41	283	2.600	2.90	16,840
October	102	48	79	0.725	0.84	4,858
The period					43.86	254,925

MEAN MONTHLY DISCHARGE in Second-feet of Fish creek near Priddis

MONTH	1907–8	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
Oct.	.....	22.0	6.80	6.8	37.0	54.0	16.9	17.0	122	79	40	2,473
Nov.	.....	.....	.....	.....	*c*24.0	*e*34.0	.....	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Jan.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Feb.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Mar.	.....	.....	.....	.....	.....	.....	.....	*h*953.0	*i*2,769	.....	.....	.....
April	.....	.....	.....	57.0	*d*36.0	*f*33.0	*g*35.0	99.0	677	.....	278	16,518
May	.....	*b*241.0	7.80	68.0	76.0	97.0	28.0	214.0	162	.....	93	5,727
June	*a*229.0	59.0	7.20	56.0	57.0	81.0	37.0	547.0	840	.....	211	12,523
July	54.0	70.0	0.48	63.0	250.0	42.0	17.3	711.0	155	.....	151	9,307
Aug.	16.7	15.8	1.50	125.0	76.0	29.0	5.1	190.0	222	.....	76	4,652
Sept.	9.5	6.7	17.00	52.0	63.0	16.4	3.5	140.0	283	.....	66	3,902
Total in acre-feet.	13,954	24,412	2,462	25,941	35,462	21,061	8,140	148,507	257,568	.....	.....	55,102

a 11-30.
b 3-31.
c 1-16.
d 22-30.
e 1-15.
f 21-30.
g 7-30.
h 15-31.
i 12-31.

NORTH BRANCH OF SHEEP RIVER NEAR MILLARVILLE

Location.—On SW. ¼ Sec. 12, Tp. 21, Rge. 3, W. 5th Mer., at Malcolm T. Miller's ranch about one and one-half miles east of Millarville post office.

Records available.—May 22, 1908, to October 31, 1916.

Gauge.—Vertical staff. Elevation of zero maintained at 3,822.67 feet during 1908-10. Elevation of zero maintained at 3,821.40 feet during 1911-16.

Bench-mark.—Permanent iron bench-mark. Elevation 3,838.73 (Dominion Western Railway datum) located 36 feet southwest of the NE. corner of Sec. 2, Tp. 21, Rge. 3, W. 5th Mer., and about 300 feet west of the gauge.

Discharge measurements.—Made at the traffic bridge about one mile down stream on the road allowance on the east boundary of Sec. 12 or at a wading station, 200 feet down stream from the gauge.

Winter flow.—Observations not taken during winter months.

Diversions.—The headgates of Malcolm T. Miller's irrigation ditch are about 2 miles above station, but during recent years this ditch has not been used.

Observer.—Malcolm T. Miller.

DISCHARGE MEASUREMENTS of North Branch, Sheep river, near Millarville, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 6	J. M. Paul	111	271	0.75	3.57	203
May 5	W. M. Edwards	112	261	0.97	3.32	253
June 21	R. J. McGuinness	114	408	2.08	4.99	849
July 26	W. M. Edwards	77	185	0.61	2.71	112
Aug. 25	do	104	394	1.18	3.27	465
Oct. 24	W. H. Hannon	83	293	0.60	2.64	176

DAILY GAUGE HEIGHT AND DISCHARGE of North Branch, Sheep river, near Millarville, for 1916

DAY	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	3.43	277	3.23	212	5.17	926
2	.....	.....	3.58	318	3.32	232	5.88	1,250
3	.....	.....	3.38	264	3.32	244	6.19	1,391
4	.....	.....	3.63	333	3.32	246	6.05	1,328
5	.....	.....	3.33	251	3.39	266	6.25	1,419
6	.....	.....	3.58	208*s*	3.27	236	4.80	758
7	.....	.....	3.58	216	3.22	224	4.70	714
8	.....	.....	3.53	210	3.07	188	4.65	693
9	3.21*g*	221	3.33	160	3.02	177	4.65	693
10	4.18	511	3.41	185	3.17	212	4.75	736
11	4.43	603	3.23	148	2.87	143	4.65	693
12	3.63	333	3.13	126	2.87	143	3.90	414
13	2.98*g*	168	3.21	150	2.90	150	3.85	399
14	2.73	113	3.18	148	2.87	143	4.05	465
15	2.68	104	3.28	172	2.92	154	4.05	465
16	2.58	88	3.23	160	3.02	177	3.85	399
17	3.18	214	3.21	156	3.02	177	3.55	310
18	3.03	179	3.21	160	3.05	184	3.50	296
19	2.88	146	3.13	152	3.15	207	3.50	296
20	3.31	246	3.08	144	3.12	200	3.50	296
21	3.58	318	3.13	154	3.07	188	4.99	844
22	3.38	264	2.93	116	3.07	188	3.50	296
23	3.03	179	2.88	104	3.09	193	3.50	296
24	2.93	157	2.93	128	3.42	274	3.00	172
25	3.03	179	2.98	138	3.56	313	2.95	161
26	2.88	146	3.08	160	3.77	375	2.95	161
27	3.08	190	3.21	190	3.77	375	4.75	736
28	2.98	168	3.28	208	4.01	451	5.68	1,159
29	2.88	146	3.13	188	4.32	592	4.65	693
30	2.78	124	3.01	162	4.81	762	3.97	438
31	2.88	146	.....	.....	5.22	949	.....	.....

g Ice going out, Mar. 9 to Mar. 13.
s Shifting conditions April 6 to May 6.

DAILY GAUGE HEIGHT AND DISCHARGE of North Branch, Sheep river, near Millarville, for 1916
—*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.62	330	2.35	86	2.65	266	2.42	172
2	3.85	399	2.30	84	2.62	260	2.40	166
3	4.02	455	2.30	88	2.68	274	2.40	164
4	3.90	414	2.38	108	4.92	1,144	2.38	156
5	3.44	280	2.45	126	4.75	1,068	2.40	162
6	3.27	236	2.55	154	4.20	820	2.60	204
7	3.20	219	2.45	140	3.65	586	2.60	203
8	3.15	207	2.35	124	3.35	470	2.50	178
9	3.15	207	3.17	332	3.20	418	2.45	166
10	3.10	195	3.35	394	3.10	388	2.50	172
11	2.45	70	2.98	290	2.95	340	2.51	175
12	2.26	50	2.75	236	2.85	308	2.46	158
13	2.12	39	2.65	220	2.90	322	2.43	152
14	2.05	35	2.58	204	2.90	318	2.43	152
15	2.05	35	2.50	192	2.85	304	2.43	150
16	1.85	23	2.47	192	2.75	276	2.41	142
17	1.85	23	2.49	200	2.67	250	2.49	160
18	1.85	23	6.14	1,660	2.62	238	2.51	158
19	1.80	22	6.09	1,650	2.57	224	2.46	148
20	1.95	29	4.51	930	2.50	206	2.56	164
21	1.90	26	4.14	780	2.48	200	2.66	188
22	1.85	23	3.83	658	2.45	192	2.56	160
23	1.85	23	3.66	596	2.45	192	2.56	160
24	1.80	22	3.44	516	2.42	184	2.64	176
25	1.80	22	3.27	465	2.40	176	2.61	170
26	2.20	45	3.07	396	2.40	176	2.66	180
27	2.65	106*s*	3.00	376	2.35	164	2.63	176
28	2.55	96	2.90	340	2.35	162	2.46	136
29	2.48	92	2.87	332	2.35	162	2.46	136
30	2.45	92	2.70	284	2.35	160	2.36	118
31	2.40	86	2.65	270	.....	.....	2.41	128*s*

s Shifting conditions, July 27 to Oct. 31.

MONTHLY DISCHARGE of North Branch, Sheep river, near Millarville, for 1916

(Drainage area 199 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (9-31)	603	88	215	1.080	0.92	9,808
April	333	104	180	0.905	1.01	10,711
May	949	143	276	1.390	1.60	16,971
June	1,419	161	630	3.170	3.54	37,488
July	455	22	127	0.638	0.74	7,809
August	1,660	84	401	2.020	2.33	24,657
September	1,144	160	342	1.720	1.92	20,350
October	204	118	162	0.814	0.94	9,961
The period	.....	.....	.....	.....	13.00	137,755

MEAN MONTHLY DISCHARGE in Second-feet, of North Branch, Sheep river, near Millarville

MONTH	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	9	.....	.....	61	20.0	56	87	162	66	4,048
November	.....	.....	.....	.....	31*a*	.....	.....	29*e*	.....	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
March	.....	.....	.....	.....	.....	.....	44*d*	215*f*	.....	.....	.....
April	227	.....	.....	104	80*b*	71.0*c*	32	180	.....	136	8,086
May	418	.....	.....	156	165	120.0	504	276	.....	273	16,793
June	233	.....	.....	180	160	97.0	581	630	.....	314	18,656
July	219	.....	.....	441	151	35.0	466	127	.....	240	14,751
August	71	.....	.....	123	84	7.3	148	401	.....	139	8,548
September	11	.....	.....	43	30	8.0	90	342	.....	87	5,195
Total in acre-ft.	71,570	553	.....	63,729	43,079	20,723	115,500	133,891	.....	.....	76,077

a 1-15.
b 15-30.
c 8-30.
d 15-31.
e 1-13.
f 9-31.

SOUTH BRANCH OF SHEEP RIVER AT BLACK DIAMOND

Location.—On steel highway bridge on road allowance between Secs. 8 and 17, Tp. 20, Rge. 2, W. 5th Mer., about one-half mile from Black Diamond post office.
Records available.—From May 23, 1908, to October 31, 1916.
Gauge.—Standard chain gauge; zero elevation maintained at 93.66 feet since establishment.
Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.
Channel.—Permanent.
Discharge measurements.—Made from traffiic bridge or by wading.
Winter flow.—No observations taken during winter months.
Observer.—Frank Starley.

DISCHARGE MEASUREMENTS of South Branch, Sheep river, at Black Diamond, in 1916

Date	Engineer	Width	Area of of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 6	J. M. Paul	71	87.9	1.73	0.61	152
May 4	W. M. Edwards	88	151.0	2.61	1.30	396
June 21	R. J. McGuinness	116	478.0	5.99	3.57	2,862
July 26	W. M. Edwards	86	164.0	2.48	1.00	407
Aug. 25	do	91	207.0	4.47	1.51	927
Oct. 13	do	84	106.0	2.04	0.41	216
Oct. 24	W. H. Hannan	83	112.0	1.93	0.41	217

DAILY GAUGE HEIGHT AND DISCHARGE of South Branch, Sheep river, at Black Diamond, for 1916

DAY	April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	0.92	249	2.24	1,013
2	.....	.....	.....	290 *e*	2.28	1,048
3	.....	.....	1.14	328	3.50	2,730
4	.....	.....	1.20	352	3.60	2,911
5	.....	.....	1.23	365	3.08	2,010
6	0.61	152	1.18	344	2.97	1,847
7	.....	200 *e*	1.32	404	2.95	1,819
8	0.93	252	1.12	320	3.00	1,890
9	0.85	226	0.94	256	3.03	1,935
10	0.75	194	0.76	198	2.97	1,847
11	0.71	182	0.70	179	2.50	1,264
12	0.70	179	0.60	149	2.41	1,170
13	0.65	164	0.62	155	2.59	1,363
14	0.64	161	0.60	149	3.09	2,025
15	0.66	167	0.72	185	3.75	3,182
16	0.58	143	0.75	194	3.65	3,002
17	0.52	127	0.80	210	3.72	3,128
18	0.45	108	0.93	252	3.63	2,965
19	0.42	99	1.09	308	3.54	2,802
20	0.40	94	1.08	305	4.05	3,726
21	0.32	74	1.10	312	3.57	2,857
22	0.28	64	1.04	290	2.66	1,580
23	0.28	64	0.96	262	2.31	1,231
24	0.28	64	1.09	308	2.38	1,296
25	0.28	64	1.10	312	2.33	1,250
26	0.57	141	1.08	305	2.45	1,364
27	0.84	223	1.30	395	3.60	2,911
28	0.87	232	1.95	776	5.90	7,074
29	0.65	164	1.80	669	3.30	2,399
30	0.44	105	1.85	704	2.58	1,494
31	.....	.....	2.12	912	.....	.....

e Discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of South Branch, Sheep river, at Black Diamond, for 1916.—*Concluded.*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.53	1,443	0.75	361	0.84	522	0.42	300
2	.....	1,766*e*	0.72	358	0.85	528	0.40	290
3	3.08	2,088	0.75	376	0.93	570	0.37	274
4	2.50	1,412	0.66	348	1.75	1,103	0.40	280
5	2.16	1,102	0.75	389	1.32	805	0.40	270
6	2.03	999	0.70	375	1.20	725	0.45	280
7	2.00	976	0.61	349	1.05	640	0.40	259
8	2.11	1,060	.....	505*e*	0.94	576	0.35	240
9	2.05	1,014	1.58	862	0.85	528	0.32	229
10	1.93	925	1.42	760	0.79	500	0.35	229
11	1.86	876	1.12	600	0.74	478	0.40	237
12	1.70	772	0.94	510	0.70	459	0.40	225*s*
13	1.70	772	0.88	490	0.72	469	0.41	218
14	1.55	681	0.85	480	0.68	450	0.40	215
15	1.46	630	0.78	455	0.63	426	0.40	215
16	1.41	603	0.75	444	0.60	411	0.40	215
17	1.40	598	0.70	430	0.57	400	0.38	211
18	1.46	630	5.50	6,870	0.55	390	0.39	213
19	1.30	546	2.85	2,310	0.50	368	0.40	215
20	1.24	517	1.94	1,240	0.48	359	0.43	222
21	1.15	474	1.74	1,080	0.46	349	0.43	222
22	1.08	441	1.70	1,055	0.45	342	0.42	220
23	0.99	400	1.80	1,140	0.43	337	0.42	220
24	0.95	385	1.72	1,080	0.37	308	0.41	218
25	0.97	393	1.51	927*d*	0.37	309	0.39	213
26	1.00	404	1.25	755	0.39	310	0.45	228
27	0.97	401*s*	1.12	680	0.40	310	0.43	222
28	0.90	385	1.05	640	0.35	290	0.38	211
29	0.85	375	0.99	604	0.32	279	0.35	204
30	0.81	370	0.95	582	0.36	286	0.35	204
31	0.78	365	0.90	556	.....	.....	0.34	202

s Shifting conditions July 27-October 12.
e Discharge estimated.
d Actual measurement.

MONTHLY DISCHARGE of South Branch, Sheep river, at Black Diamond, for 1916

(Drainage area 248 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
April (6-30)	252	64	146	0.589	0.55	7,238
May	912	149	337	1.360	1.57	20,721
June	7,074	1,013	2,238	9.020	10.06	133,170
July	2,088	365	768	3.100	3.57	47,222
August	6,870	348	891	3.590	4.14	54,785
September	1,103	279	461	1.860	2.08	27,431
October	300	202	232	0.935	1.08	14,265
The period	.....	.....	.....	.....	23.05	304,832

MEAN MONTHLY DISCHARGE in Second-feet of South Branch, Sheep river, at Black Diamond

MONTH	1908-9	1909-10	1910-11	1911-12	1912-13	1913-14	1914-15	1915-16	1916-17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	78	136	162	128	111	157	187	232	149	9,151
Nov.	.....	.....	.....	.....	93*c*	.....	.....	.....	.....	.....	.....
Dec.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Feb.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
March	.....	.....	116*b*	.....	.....	.....	75*e*	.....	.....	.....	.....
April	.....	.....	98	236	152*d*	108	99	146*f*	.....	354	8,048
May	.....	.....	286	279	250	310	952	337	.....	402	24,739
June	.....	278	606	501	532	414	1,524	2,238	.....	870	51,797
July	567*a*	139	250	788	346	206	1,017	768	.....	502	30,867
August	228	127	544	250	310	104	390	891	.....	356	21,857
Sept.	116	228	450	134	164	107	228	461	.....	236	14,043
Total in Acre-feet	42,277	51,261	144,525	142,841	112,892	82,375	266,480	302,065	.....	.....	160,502

a 13-31.
b 27-31.
c 1-15.
d 14-30.
e 21-31.
f 6-30.

SHEEP RIVER NEAR OKOTOKS

Location.—On the NW. ¼ Sec. 22, Tp. 20, Rge. 29, W. 4th Mer., at the Canadian Pacific Railway Company's bridge about one mile southeast of Okotoks.

Records available.—From May 7, 1909, to December 31, 1916.

Gauge.—Chain gauge; zero elevation maintained at 3,419.12 during 1915 and 1916. High water staff gauge is imbedded in the cement on centre pier; elevation of the zero maintained at 3,419.57 feet during 1912-16.

Bench-mark.—Top of the left abutment of southwest corner; elevation 3,431.57 feet above mean sea-level (C.P.R. datum).

Channel.—Gravel, very shifting.

Discharge measurements.—From bridge or by wading.

Winter flow.—Records taken in 1916

Observer.—Miss M. B. Henderson.

DISCHARGE MEASUREMENTS of Sheep river near Okotoks, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 5	J. M. Paul	124	259	1.71	3.46	444
May 6	W. M. Edwards	147	295	2.37	3.73	700
May 31	do	281	881	4.27	5.60	3,754
June 19	R. J. McGuinness	268	925	3.80	5.50	3,498
June 24	do	198	660	3.55	4.61	2,343
June 26	do	198	626	3.45	4.60	2,159
July 5	do	231	642	4.05	5.03	2,599
July 28	W. M Edwards	148	253	1.97	3.36	497
Aug. 24	do	254	685	2.58	3.79	1,766
Oct. 23	W. H. Hannan	95	250	1.41	1.60	354
Dec. 1	W. M. Edwards	80	59	2.11	3.53	125
Dec. 18	do	94	90	1.22	3.57*b*	110

b Ice conditions.

DAILY GAUGE HEIGHT AND DISCHARGE of Sheep river near Okotoks, for 1916

DAY	March		April		May		June		July	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	3.76	728	3.56	535	.....	3,402*e*	4.85	2,425
2	.....	.....	3.81	781	3.60	570	5.30	3,105	5.85	4,320
3	.....	.....	3.66	627	3.71	676	5.60	3,700	5.75	4,090
4	.....	.....	3.66	627	.....	656*e*	5.75	4,000	5.50	3,555
5	.....	.....	3.38	386	.....	637*e*	5.80	4,100	5.03	2,598*s*
6	.....	.....	3.56	535	3.65	618	.....	3,900*e*	4.75	2,125
7	.....	.....	.....	535*e*	3.85	825	5.60	3,700	4.60	1,900
8	.....	.....	3.56	535	3.55	526	5.55	3,600	4.40	1,615
9	...*g*...	.....	3.56	535	3.45	441	.....	3,800*e*	.....	1,489*e*
10	.....	.....	3.51	491	3.30	328	5.75	4,000	4.08	1,198
11	.....	.....	3.46	449	3.30	328	.....	3,270*e*	3.83	905
12	...*g*...	.....	3.46	449	3.25	296	5.00	2,540	3.76	835
13	.....	.....	3.46	449	3.27	309	5.00	2,540	3.68	755
14	.....	.....	3.46	449	3.25	296	5.10	2,720	3.53	620
15	.....	.....	3.41	408	3.32	342	5.40	3,300	3.48	580
16	.....	.....	3.41	408	.....	392*e*	5.45	3,400	3.40	518
17	.....	.....	3.41	408	3.45	441	.....	3,432*e*	3.38	502
18	3.59	561	3.31	335	.....	441*e*	.....	3,465*e*	3.35	485
19	3.19	259	3.26	303	3.45	441	5.50	3,500*s*	3.28	438
20	.....	260*e*	3.23	284	3.60	570	5.80	4,240	3.08	323
21	.....	261*e*	3.21	271	3.65	618	4.61	2,065	3.08	323
22	.....	263*e*	3.06	188	3.70	665	4.90	2,680	2.98	271
23	.....	264*e*	3.04	178	3.65	618	4.75	2,510	2.93	250
24	.....	266*e*	3.01	163	4.00	995	4.55	2,240	2.88	225
25	.....	268*e*	3.06	188	4.00	995	3.60	810	3.08	323
26	.....	270*e*	3.21	271	4.10	1,120	4.60	2,159	3.03	300
27	3.21	271	3.46	449	4.20	1,250	6.30	5,440	3.08	323
28	3.11	214	3.46	449	.....	2,875*e*	7.55	7,900	3.36	497
29	3.11	214	3.46	449	6.00	4,500	5.75	4,200	3.15	362
30	3.11	214	3.41	408	5.90	4,300	5.20	3,120	3.10	336
31	3.11	214	.....	.....	5.60	3,700	.....	.....	3.10	336

g Ice going out, Mar. 9 to Mar. 12.
e Discharge estimated.
s Shifting conditions, June 19 to July 5.

DAILY GAUGE HEIGHT AND DISCHARGE of Sheep river near Okotoks, for 1916—*Concluded*

DAY	August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.10	336	2.05	508	1.55	345	.....	345*e*	3.53*x*	125
2	.....	336*e*	.....	1,474*e*	.....	348*e*	1.55	345	3.50	124
3	3.10	336	.....	2,440*e*	.....	351*e*	1.55	345	.....	123*e*
4	3.07	319	4.85	3,405	1.58	354	.....	338*e*	3.75	123
5	3.25	420	4.55	2,865	1.60	360	1.50	330	3.83	122
6	.....	364*e*	4.10	2,160	1.60	360	.....	330*e*	4.00	121
7	3.05	308	3.80	1,778	1.60	360	1.50	330	4.55	121
8	3.15	362	3.00	1,015	1.60	360	1.50	330	4.75	120
9	4.35	1,550	2.70	814	.....	360*e*	.....	330*e*	4.87*b*	120
10	4.00	1,100	2.50	703	1.60	360	1.50	330	5.00	120
11	3.75	824	2.40	655	1.55	345	.....	330*e*	5.00	119
12	3.35	486	2.25	589	.....	345*e*	1.50	330	4.83	118
13	.....	411*e*	2.00	490	1.55	345	.....	330*e*	.....	117*e*
14	3.10	336	.....	490*e*	1.55	345	1.50	330	4.45	116
15	3.00	283	2.00	490	.....	345*e*	1.50	330	3.90	115
16	.....	269*e*	1.95	472	1.55	345	.....	334*e*	3.75	113
17	2.95	255*s*	1.80	420	1.55	345	1.53	339	3.70	112
18	7.80	9,345	.....	412*e*	1.57	351	1.53	339	3.57	110
19	7.10	8,065	1.75	405	1.63	369	1.55	345	3.65	108
20	4.35	2,535	1.60	360	1.65	375	1.55	345	3.60	106
21	4.15	2,232	1.60	360	1.70	390	1.55	345	3.55	104
22	4.05	2,093	1.60	360	.....	375*e*	1.53	339	.....	102*e*
23	4.00	2,026	1.57	351	1.60	360	.....	334*e*	3.55	100
24	3.79	1,766	1.55	345	1.60	360	1.50	330	3.55	98
25	3.90	1,899	1.55	345	.....	360*e*	1.50	330	.....	96*e*
26	.....	1,810*e*	1.55	345	1.60	360	.....	330*e*	.....	94*e*
27	3.75	1,720	.....	345*e*	1.55	345	1.50	330	3.40	92
28	3.05	1,054	1.55	345	1.55	345	1.50	330	3.40	90
29	2.35	632	.....	345*e*	.....	345*e*	1.50	330	3.60	87
30	2.25	589	1.55	345	1.55	345	1.50	330	.....	85*e*
31	2.15	548	.....	.....	1.55	345	.....	.....	.....*b*	83*e*

b Ice conditions, Dec. 9 to Dec. 31.
e Discharge estimated.
x Gauge moved over main channel Dec. 1.
s Shifting conditions Aug. 17 to Aug. 20.

MONTHLY DISCHARGE of Sheep river near Okotoks, for 1916

(Drainage area 632 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (18-31)	561	214	271	0.429	0.22	7,518
April	781	163	424	0.671	0.75	25,230
May	4,500	296	1,010	1.600	1.84	62,102
June	7,900	810	3,428	5.420	6.05	203,932
July	4,320	225	1,123	1.780	2.05	69,034
August	9,345	255	1,439	2.280	2.63	88,459
September	3,405	345	838	1.330	1.48	49,864
October	390	345	355	0.562	0.65	21,828
November	345	330	334	0.529	0.59	19,874
December	125	83	109	0.172	0.20	6,702
The period	.....	.....	.....	.....	16.46	554,543

MEAN MONTHLY DISCHARGE in Second-feet, of Sheep river near Okotoks

MONTH	1907–8	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
Oct.	.....	192	88	156	281	263	148	212	382	355	231	14,186
Nov.	.....	.....	.....	.....	230	*d*175	.....	.....	.....	334	282	11,078
Dec.	.....	.....	.....	.....	.....	.....	.....	.....	.....	109	109	6,702
January	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Feb.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Mar.	.....	.....	.....	.....	.....	.....	.....	*f*156	*g*271	.....	.....	.....
April	*a*174	.....	112	273	*c*305	345	*e*228	124	424	.....	256	15,210
May	969	*b*2,071	251	563	510	466	517	1,330	1,010	.....	702	43,164
June	2,397	2,018	251	855	915	735	563	2,871	3,428	.....	1,559	92,773
July	444	1,034	119	386	1,682	463	330	3,920	1,123	.....	1,056	64,911
August	187	318	115	853	387	411	128	847	1,439	.....	521	32,008
Sept.	123	130	210	688	221	194	108	466	838	.....	331	19,686
Total in acre-feet.	257,267	325,474	69,314	228,423	251,780	179,579	121,164	598,505	529,627	.....	.....	299,718

a 5-30.
b 7-31.
c 6-15.
d 1-15.
e 4-30.
f 17-31.
g 18-31.

HIGHWOOD RIVER AT BROWN'S RANCH

Location.—On SE. ¼ Sec. 20, Tp. 18, Rge. 2, W. 5th Mer., at B. F. Brown's ranch, about eight miles north of Pekisko and five miles west of Longview post office.

Records available.—July 27, 1912, to December 31, 1916.

Gauge.—Vertical staff. Elevation of zero maintained at 93.90 feet during 1912. Elevation of zero maintained at 91.97 feet during 1913-1916.

Bench-mark.—Permanent iron bench-mark, assumed elevation 100.00 feet.

Channel.—Shifts during floods.

Discharge measurements.—Made from the traffic bridge one and one-half miles down stream or by wading near bridge.

Winter flow.—Not taken until 1916.

Observer.—B. F. Brown.

DISCHARGE MEASUREMENTS of Highwood river at Brown's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 3	J. M. Paul	55	71.6	2.95	0.80	211
May 4	W. M. Edwards	192	306.0	3.42	1.87	1,045
May 27	do	184	261.0	3.40	1.75	887
July 8	R. J. McGuinness	193	521.0	5.61	3.65	2,931
July 25	W. M. Edwards	154	287.0	3.20	1.40	919
Aug. 22	do	156	358.0	3.49	1.75	1,249
Sept. 20	do	123	224.0	1.89	0.80	424
Oct. 27	do	121	222.0	1.69	0.65	374
Nov. 30	do	119	121.0	1.58	0.65*b*	191
Dec. 16	do	114	176.0	0.82	0.85*b*	146

b Ice conditions.

DAILY GAUGE HEIGHT AND DISCHARGE of Highwood river at Brown's ranch, for 1916

DAY	March		April		May		June		July	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			0.75	192	1.47	641	2.25	1,552	3.59	3,300
2			0.75	192	1.52	686	2.30	1,675	4.22	4,200
3			0.80	211	1.55	714	3.55	3,579	4.16	4,050
4			0.81	216	1.87	1,045	3.50	3,500	4.23	4,100
5			1.00	311	2.05	1,272	3.60	3,658	2.96	2,060
6			1.03	328	2.08	1,313	3.25	3,105	1.94	780
7			1.00	311	2.25	1,552	3.05	2,789	3.65	3,000
8			1.02	323	1.95	1,142	3.10	2,868	3.65	2,930
9			0.97	295	1.80	963	3.30	3,184	3.77	3,200
10			1.03	328	1.65	808	3.40	3,342	3.62	3,050
11			1.02	323	1.58	741	3.05	2,789	3.47	2,910
12			1.01	317	1.53	695	2.90	2,552	3.27	2,700
13			0.97	295	1.55	714	2.85	2,473	3.16	2,600
14			0.97	295	1.45	624	3.15	2,947	3.03	2,490
15			1.12	382	1.40	580	3.90	4,132	2.81	2,240
16			1.02	323	1.38	564	4.45	5,001	2.71	2,160
17			1.12	382	1.40	580	4.70	5,396	2.73	2,260
18			1.05	340	1.43	606	4.95	5,791	2.62	2,180
19			1.02	323	1.45	624	4.25	4,685	2.63	2,260
20			1.02	323	1.55	714	4.10	4,448	2.43	2,020
21			1.00	311	1.68	837	3.70	3,816	2.28	1,860
22			0.97	295	1.75	910	3.40	3,342	2.26	1,880
23			0.92	269	1.70	856	3.20	3,026	2.08	1,680
24			0.97	295	1.70	856	3.15	2,947	2.03	1,630
25			0.92	269	1.65	808	3.45	3,421	1.40	895*s*
26	1.30	500	1.12	382	1.60	760	3.30	3,184	1.45	942
27	1.30	500	1.42	597	1.75	910	4.25	4,600*s*	1.40	895
28	1.25	466	1.52	686	1.85	1,022	6.50	8,040	1.34	838
29	1.20	432	1.42	597	2.15	1,410	4.72	5,190	1.25	758
30	1.15	400	1.32	516	2.15	1,410	3.77	3,650	1.20	715
31	0.95	284			2.20	1,480			1.15	675

s Shifting conditions. June 27 to July 25.

DAILY GAUGE HEIGHT AND DISCHARGE of Highwood river at Brown's ranch, for 1916—*Concluded*

DAY	August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.10	635	1.05	600	0.65	368	0.54	318	0.50	188
2	1.07	614	1.07	614	0.70	390	0.53	314	0.55	185
3	1.03	586	1.00	565	0.68	381	0.54	318	0.60	182
4	1.02	579	1.85	1,388	0.65	368	0.55	322	0.67	179
5	0.98	552	1.66	1,161	0.67	376	0.55	322	0.65	176
6	0.95	532	1.85	1,388	0.75	415	0.50	300	0.55	174
7	0.93	520	1.43	924	0.70	390	0.45	285	0.22	170
8	0.93	520	1.32	819	0.68	381	0.41	273	0.65	167
9	1.34	838	1.20	715	0.65	368	0.47	291	0.50	164
10	1.44	933	1.05	600	0.65	368	0.40	270	0.60	161
11	1.20	715	1.05	600	0.70	390	0.35	255	0.65	157
12	1.05	600	0.98	552	0.69	386	0.35*b*	258	0.70	155
13	1.00	565	1.01	572	0.65	368	1.01	262	0.75	152
14	0.95	532	0.95	532	0.65	368	0.85	264	0.80	150
15	0.90	500	0.93	520	0.65	368	1.04	265	0.93	148
16	0.88	488	0.91	506	0.68	381	1.02	264	0.85	146
17	0.85	470	0.87	482	0.72	400	0.96	261	0.75	143
18	3.45	3,778	0.82	452	0.70	390	0.93	255	0.73	140
19	2.39	2,136	0.79	435	0.67	376	0.85	250	0.70	137
20	2.00	1,585	0.80	440	0.75	415	0.60	242	0.70	134
21	1.85	1,388	0.75	415	0.72	400	0.67	235	0.67	131
22	1.75	1,265	0.73	405	0.70	390	0.73	228	0.65	128
23	1.88	1,425	0.70	390	0.65	368	0.65	223	0.60	124
24	1.80	1,325	0.70	390	0.67	376	0.64	218	0.90	121
25	1.75	1,265	0.67	376	0.65	368	0.62	212	1.10	118
26	1.58	1,074	0.65	368	0.66	372	0.64	207	1.09	115
27	1.46	952	0.61	350	0.65	368	0.53	203	1.05	113
28	1.35	848	0.70	390	0.63	358	0.56	198	1.00	112
29	1.25	758	0.65	368	0.60	345	0.55	194	1.03	110
30	1.15	675	0.68	381	0.55	322	0.65	191	1.07	109
31	1.10	635	.....	.....	0.55	322	.....	.....	1.05*b*	109

b Ice conditions, Nov. 12 to Dec. 31.

MONTHLY DISCHARGE of Highwood river at Brown's ranch, for 1916

(Drainage area 421 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (26-31)	500	284	430	1.020	0.22	5,116
April	686	192	341	0.810	0.90	20,291
May	1,552	564	898	2.130	2.46	55,216
June	8,040	1,552	3,689	8.760	9.77	219,458
July	4,200	675	2,170	5.150	5.94	133,430
August	3,778	470	945	2.240	2.58	58,106
September	1,388	350	590	1.400	1.56	35,107
October	415	322	375	0.891	1.03	23,058
November	3,221	191	257	0.610	0.68	15,293
December	188	109	145	0.344	0.40	8,916
The period	.....	.....	.....	.....	25.54	573,991

PEKISKO CREEK AT PEKISKO

Location.—On the NW. ¼ Sec. 8, Tp. 17, Rge. 2, W. 5th Mer., at George Lane's Bar U ranch, and about twenty-five miles southwest of High River.

Records available.—October 6, 1911, to October 31, 1916.

Gauge.—Vertical staff; elevation of zero of gauge is 93.90 feet which has been unchanged since establishment.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—Fairly permanent.

Discharge measurements.—Made from a small suspension foot-bridge or by wading.

Winter flow.—Observations not taken during winter months.

Diversions.—The headgates of George Lane's irrigation ditch are about one and one-half miles up stream from station.

Observer.—T. A. Thronsen.

DISCHARGE MEASUREMENTS of Pekisko creek at Pekisko, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq.-ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 3	J. M. Paul	53	45.8	1.01	1.39	46
May 3	W. M. Edwards	49	54.6	1.63	1.74	89
May 26	do	53	55.9	1.74	1.73	97
July 6	R. J. McGuinness	57	107.0	1.89	2.18	203
July 24	W. M. Edwards	52	45.8	1.24	1.49	57
Aug. 23	do	55	66.3	2.07	1.88	137
Sept. 21	do	33	26.4	1.98	1.47	52
Oct. 26	do	53	49.4	1.46	1.63	72

DAILY GAUGE HEIGHT AND DISCHARGE of Pekisko creek at Pekisko, for 1916

Day	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			1.64	77	1.72	90	2.51	322
2			1.50	58	1.70	87	2.60	354
3			1.39	45	1.74	94	2.95	476
4			1.42	48	1.84	113	3.26	585
5			1.38	44	1.84	113	3.40	634
6			1.47	54	1.84	113	2.90	459
7			1.46	53	1.82	109	2.78	417
8			1.52	61	1.74	94	2.72	396
9			1.46	53	1.72	90	2.74	403
10	2.49	316	1.54	63	1.66	81	2.76	410
11	2.54	333	1.60	71	1.63	76	2.52	326
12	2.16	202	1.53	62	1.66	81	2.44	298
13	2.00	153	1.48	56	1.67	82	2.44	298
14	1.82	109	1.47	54	1.66	81	2.44	298
15	1.65	79	1.56	66	1.64	77	2.58	347
16	1.56	66	1.54	63	1.65	79	2.58	347
17	1.52	61	1.54	63	1.68	84	2.48	312
18	1.48	56	1.54	63	1.69	85	2.42	291
19	1.44	51	1.52	61	1.70	87	2.40	284
20	1.57	67	1.48	56	1.70	87	2.49	316
21	1.53	62	1.48	56	1.71	89	2.43	294
22	1.54	63	1.48	56	1.71	89	2.25	232
23	1.46	53	1.43	50	1.72	90	2.13	192
24	1.31	37	1.42	48	1.79	102	2.06	170
25	1.51	59	1.40	46	1.83	111	2.07	173
26	1.36	42	1.56	66	1.73	92	2.11	185
27	1.34	40	1.62	74	1.90	127	2.31	252
28	1.38	44	1.67	82	2.25	232	3.35	266
29	1.38	44	1.64	77	2.43	294	2.76	410
30	1.44	51	1.64	77	2.55	336	2.55	336
31	1.40	46			2.63	364		

DAILY GAUGE HEIGHT AND DISCHARGE of Pekisko creek at Pekisko, for 1916—*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.33	260	1.34	40	1.46	53	1.48	56
2	2.87	448	1.32	38	1.49	57	1.49	57
3	2.85	442	1.32	38	1.58	68	1.50	58
4	2.49	316	1.31	37	2.38	277	1.46	53
5	2.31	252	1.31	37	2.10	182	1.51	59
6	2.21	218	1.31	37	1.90	127	1.64	77
7	2.16	202	1.29	35	1.86	118	1.60	71
8	2.10	182	1.28	34	1.74	94	1.54	63
9	2.02	159	1.57	67	1.72	90	1.54	63
10	1.94	137	1.61	73	1.68	84	1.56	66
11	1.86	118	1.52	61	1.63	76	1.58	68
12	1.82	109	1.40	46	1.58	68	1.58	68
13	1.80	104	1.34	40	1.64	77	1.60	71
14	1.74	94	1.30	36	1.60	71	1.62	74
15	1.71	89	1.26	32	1.57	67	1.62	74
16	1.68	84	1.23	29	1.54	63	1.63	76
17	1.66	81	1.21	27	1.52	61	1.64	77
18	1.70	87	2.95	476	1.50	58	1.64	77
19	1.64	77	2.40	284	1.47	54	1.65	79
20	1.60	77	2.12	189	1.44	51	1.66	81
21	1.54	63	2.01	156	1.42	48	1.66	81
22	1.51	59	1.95	140	1.43	50	1.64	77
23	1.51	59	1.88	122	1.46	53	1.64	77
24	1.48	56	1.81	106	1.43	50	1.62	74
25	1.46	53	1.72	90	1.44	51	1.58	68
26	1.62	74	1.70	87	1.42	48	1.62	74
27	1.56	66	1.64	77	1.42	48	1.60	71
28	1.44	51	1.58	68	1.41	47	1.56	66
29	1.40	46	1.54	63	1.39	45	1.56	66
30	1.38	44	1.50	58	1.42	48	1.58	68
31	1.36	42	1.46	53			1.54	63

MONTHLY DISCHARGE of Pekisko creek at Pekisko, for 1916

(Drainage area 99 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (10-31)	333	37	92	0.929	0.76	4,014
April	82	44	60	0.606	0.68	3,570
May	364	76	120	1.210	1.40	7,378
June	634	170	336	3.390	3.78	19,993
July	448	42	134	1.350	1.56	8,239
August	476	27	86	0.868	1.00	5,288
September	277	45	76	0.767	0.86	4,522
October	81	53	69	0.697	0.80	4,243
The period					10.84	57.247

STIMSON CREEK NEAR PEKISKO

Location.—On the SE. ¼ Sec. 14, Tp. 17, Rge. 2, W. 5th Mer., near E. R. Baker's ranch and about five miles from Pekisko post office; at the traffic bridge on the surveyed trail running southwest from High River.

Records available.—From October 6, 1911, to October 31, 1916.

Gauge.—Vertical staff; zero elevation maintained at 92.54 from date of establishment to June 30, 1912, and at 90.20 during 1916. From June 30, 1912, to October 31, 1915, the gauge was located on NW. ¼ Sec. 2, Tp. 17, Rge. 2, W. 5th Mer.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—Coarse gravel, fairly permanent.

Discharge measurements.—From bridge or by wading.

Winter flow.—No observation taken during winter months.

Observer.—W. Garrett.

DISCHARGE MEASUREMENTS of Stimson creek near Pekisko, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 4	J. M. Paul	44	46.8	1.59	4.27	74
May 3	W. M. Edwards	46	44.5	1.11	3.88	49
May 26	do	54	90.0	1.78	4.13	160
July 6	R. J. McGuinness	73	87.5	1.90	4.10	166
July 24	W. M. Edwards	41	36.1	1.02	3.65	37
Aug. 23	do	30	27.2	1.73	3.71	47
Sept. 21	do	43	39.2	0.66	3.60	26
Oct. 26	do	49	56.2	1.11	3.80	63

DAILY GAUGE HEIGHT AND DISCHARGE of Stimson creek near Pekisko, for 1916

DAY	April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	3.86	41	5.10	810
2	.....	.....	3.88	47	4.70	505
3	.....	.....	3.88	49*d*	4.70	505
4	4.27	74*ds*	3.83	42	4.70	505
5	4.10	41	3.81	40	4.80	573
6	4.10	43	3.79	39	4.80	573
7	4.10	45	3.74	33	4.60	439
8	4.50	160	3.74	34	4.45	344
9	4.50	165	3.72	33	4.40	313
10	4.50	169	3.69	30	4.40	313
11	4.00	35	3.71	34	4.35	284
12	3.95	28	3.76	42	4.30	256
13	3.95	29	3.83	58	4.20	202
14	3.95	30	3.84	60	4.25	229
15	3.95	32	3.86	66	4.10	158
16	3.90	26	3.83	60	4.10	158
17	3.90	28	3.80	56	4.10	158
18	3.90	29	3.78	52	4.10	158
19	3.88	27	3.80	58	4.00	120
20	3.80	17	3.80	59	4.10	158
21	3.80	19	3.73	45	4.20	202
22	3.80	20	3.70	40	4.00	120
23	3.80	21	3.75	49	4.10	158
24	3.78	20	3.93	90	4.00	120
25	3.75	17	4.13	160	4.00	120
26	3.73	16	4.15	160*d*	4.00	120
27	3.73	17	4.22	212	4.30	256
28	3.73	18	4.22	212	5.30	983
29	3.77	25	4.40	313	4.85	612
30	3.78	27	4.19	198	4.42	325
31	.....	.....	5.10	810	.....	.....

d Actual measurement.
s Shifting conditions, April 4 to May 27.

DAILY GAUGE HEIGHT AND DISCHARGE of Stimson creek near Pekisko, for 1916—*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.15	180	3.60	28.0	3.50	14.5	3.66	38
2	5.30	983	3.50	14.5	3.48	12.1	3.70	45
3	5.00	729	3.50	14.5	3.47	10.9	3.70	45
4	4.50	375	3.50	14.5	4.80	573.0	3.70	45
5	4.50	375	3.50	14.5	4.85	612.0	3.72	49
6	4.20	202	3.55	22.0	3.88	85.0	3.72	49
7	4.10	158	3.55	22.0	3.88	85.0	3.86	80
8	4.00	120	3.55	22.0	3.86	80.0	3.83	72
9	4.00	120	4.17	189.0	3.86	80.0	3.79	63
10	4.00	120	3.85	78.0	3.83	72.0	3.79	63
11	3.90	90	3.80	65.0	3.82	70.0	3.80	65
12	3.90	90	3.75	55.0	3.82	70.0	3.70	45
13	3.80	65	3.60	28.0	3.82	70.0	3.70	45
14	3.80	65	3.60	28.0	3.80	65.0	3.70	45
15	3.80	65	3.50	14.5	3.80	65.0	3.70	45
16	3.80	65	3.50	14.5	3.79	63.0	3.70	45
17	3.80	65	3.50	14.5	3.78	61.0	3.70	45
18	3.80	65	5.10	810.0	3.74	53.0	3.75	55
19	3.80	65	4.50	375.0	3.71	47.0	3.75	55
20	3.80	65	4.50	375.0	3.67	40.0	3.75	55
21	3.80	65	4.20	202.0	3.62	32.0	3.77	59
22	3.80	65	4.00	120.0	3.60	28.0	3.77	59
23	3.70	45	3.70	45.0	3.60	28.0	3.78	61
24	3.70	45	3.55	22.0	3.60	28.0	3.78	61
25	3.65	37	3.55	22.0	3.59	27.0	3.79	63
26	3.65	37	3.75	55.0	3.59	27.0	3.79	63
27	3.60	28	3.70	45.0	3.60	28.0	3.79	63
28	3.60	28	3.55	22.0	3.60	28.0	3.79	63
29	3.60	28	3.52	17.3	3.62	32.0	3.77	59
30	3.60	28	3.50	14.5	3.62	32.0	3.75	55
31	3.60	28	3.50	14.5			3.69	43

MONTHLY DISCHARGE of Stimson creek near Pekisko, for 1916

(Drainage area 78 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
April (4-30)	169	16.0	44	0.564	0.57	2,357
May	810	30.0	104	1.330	1.53	6,395
June	983	120.0	326	4.180	4.66	19,398
July	983	28.0	145	1.860	2.14	8,916
August	810	14.5	90	1.150	1.33	5,534
September	612	10.9	84	1.080	1.20	4,998
October	80	38.0	55	0.705	0.81	3,382
The period					12.24	50,980

FINDLAY AND MCDOUGAL DITCH FROM HIGHWOOD RIVER

Location.—On SW. ¼ Sec. 31, Tp. 18, Rge. 29, W. 4th Mer., about four and one-half miles west of the town of High River.

Records available.—June 17, 1911, to October, 1916. Discharge measurements only during 1914-15.

Gauge.—Vertical staff; zero elevation maintained at 99.25 feet since establishment.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—Soft mud liable to shift.

Discharge measurements.—By wading.

Winter flow.—Ditch closed at freeze-up.

Artificial control.—Discharge at station may be controlled by means of the headgates about one-quarter mile above station.

Observer.—J. C. Pike.

DISCHARGE MEASUREMENTS of Findlay and McDougall ditch from Highwood river, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 1	J. M. Paul					Nil
May 4	W. M. Edwards	5.0	2.20	0.48	1.04	1.06
May 27	do				0.96	.....*x*
July 25	do	5.0	2.70	0.11	1.16*h*	0.29
Aug. 22	do				0.92	.....*x*

x No flow, water in pools.
h Headgate closed, discharge surface flow only.

DAILY GAUGE HEIGHT IN FEET of Findlay and McDougall ditch from Highwood River, for 1916

DAY	May	June	July	August
1				
2				
3	1.80*h*	1.50		2.00
4	1.04*h*	1.50		1.80
5				0.92
6				1.25
7				1.00
8				0.80
9				0.72
10				0.70
11			1.90	0.60
12			1.55	0.52
13			1.40	0.50
14			1.35	
15	1.45*h*		1.25	
16	1.50		1.12	
17	1.35		1.10	
18	1.50		1.10	
19	1.55			
20	1.50			
21	1.65			
22	1.70			0.92
23	1.80			
24	2.00			
25	1.65		1.16	
26	1.50			1.00
27	0.96			
28	1.17			
29	1.50			
30	1.65			
31	1.45			

h Ditch opened May 3-4 for stock, closed May, 5-15; opened for irrigation May 15, closed May 27; leakage May 28 to June 5; headgate closed completely June 6 to July 10; closed July 19 to August 2. Final closing of headgate not recorded.

LITTLE BOW DITCH FROM HIGHWOOD RIVER

Location.—On the SW. ¼ Sec. 6, Tp. 19, Rge. 28, W. 4th Mer., about 100 feet from the power station and pumping plant of the town of High River.

Records available.—August 1, 1910, to December 31, 1915.

Gauge.—Vertical staff. Zero elevation maintained at 91.06 feet during 1910-11. Zero elevation maintained at 92.06 feet from 1912, to September 9, 1915, and at 91.68 since that date.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—Fairly permanent.

Discharge measurements.—Made by wading with current-meter.

Winter flow.—Continuous records kept during winter.

Artificial control.—Formed by headgates of ditch about twenty feet below station.

Observer.—Philip Weinard.

Remarks.—Ditch works damaged by flood, ditch not used after July 15, 1916.

DISCHARGE MEASUREMENTS of Little Bow ditch from Highwood River, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 6	F. K. Beach					Nil
Feb. 4	R. N. Hayden	13.0	18.20	0.06	3.15	1.02
Mar. 7	S. H. Frame	17.2	24.20	0.54	1.67	13.10
April 1	J. M. Paul	17.5	13.90	0.86	0.83	12.00
May 3	W. M. Edwards	17.0	24.20	1.09	1.37	27.00
May 26	do	17.0	26.40	1.29	1.47	34.00
July 8	R. J. McGuinness	4.0	2.50	2.79	0.84	7.00
July 24	W. M. Edwards					Nil
Aug. 23	do					Nil
Nov. 30	do					Nil
Dec. 16	do					Nil

DAILY GAUGE HEIGHT AND DISCHARGE of Little Bow ditch from Highwood River, for 1916

DAY	January		February		March		April	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	0.00*b*	Nil	3.20	1.44	1.70	6.0	0.75	8.7
2	0.00	"	3.20	1.44	1.60	5.0	1.19	22.0
3	0.00	"	3.00	1.10	1.62	6.4	1.00	15.5
4	0.00	"	3.15	1.02*d*	1.70	9.4	1.00	15.5
5	0.00	"	3.00	1.00	1.68	10.1	0.90	12.5
6	0.00	"	3.10	2.20	1.67*b*	13.1*d*	0.88	11.9
7	0.00	"	3.05	2.10	1.67	13.0*e*	0.85	11.1
8	0.00	"	3.05	3.50	1.55	15.0	0.84	10.8
9	0.35	2.00*e*	3.05	4.50	1.55	15.0	0.90	12.5
10	0.00	Nil	3.04	5.60	2.25	10.0	0.90	12.5
11	0.00	"	3.00	6.20	2.35	10.0	0.80	9.8
12	0.00	"	3.00	7.50	2.75	10.0	0.85	11.1
13	0.00	"	3.00	9.60	1.85	11.0	0.82	9.3
14	0.00	"	3.02	12.00	1.65	12.0	0.70	7.6
15	0.60	1.60*e*	3.02	14.00	1.35	15.0	0.80	9.8
16	2.50	1.70	3.60	37.00	1.30	17.0	0.80	9.8
17	2.45	1.60	3.60	40.00	1.30	17.0	0.76	8.9
18	2.85	1.40	3.23	29.00	1.30	17.0	0.65	6.8
19	2.90	1.40	3.15	28.00	1.30	18.0	0.65	6.8
20	2.90	1.40	3.15	30.00	1.70	19.0	0.60	6.0
21	2.93	1.40	3.05	29.00	1.75	20.0	0.60	6.0
22	3.00	1.50	3.03	30.00	1.75	21.0*e*	0.68	7.3
23	2.70	1.35	2.98	30.00	1.00	15.5	0.65	6.8
24	2.88	1.40	2.75	24.00	0.95	14.0	0.63	6.5
25	2.38	1.20	2.47	17.00	0.70	7.6	0.60	6.0
26	2.52	1.00	1.94	5.50	1.00	15.5	0.60	6.0
27	2.87	0.50*e*	1.65	2.60	0.90	12.5	0.70	7.6
28	3.05	0.38	1.45	1.50	0.75	8.7	1.35	28.0
29	3.05	0.38	2.05	12.00	0.75	8.7	1.32	26.0
30	3.10	0.68	.....	.....	0.70	7.6	1.36	28.0
31	3.15	1.02	.....	.....	0.70	7.6	.....	.....

e Discharge estimated January 9 and January 15 to 27 during spring break-up March 7 to 22.
d Actual measurement.
b-b Ice conditions discharge estimated and computed by Bolster method.

DAILY GAUGE HEIGHT AND DISCHARGE of Little Bow ditch from Highwood River, for 1916.—*Concluded.*

DAY	May		June		July	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.40	30	3.27	128	1.70	42.0
2	1.40	30	3.27	128	1.80	46.0
3	1.37	28	3.30	130	1.80	46.0
4	1.40	30	3.30	130	1.50	34.0
5	2.32	72	3.30	130	1.00	15.5
6	2.28	70	3.00	111	0.95	14.0
7	2.50	81	2.95	108	0.92	13.1
8	2.05	58	2.93	107	0.92	13.1
9	1.65	40	2.93	107	0.95	14.0
10	1.45	32	2.95	108	0.90	12.5
11	1.45	32	2.90	105	0.75	8.7
12	1.40	30	2.90	105	0.70	7.6
13	1.35	28	2.80	99	0.60	6.0
14	1.30	26	2.75	96	0.50	4.5
15	1.28	25	2.80	99	0.40	3.2
16	1.25	24	2.80	99	0.00	Nil
17	1.25	24	2.85	102	.....	.....
18	1.25	24	2.90	105	.....	.....
19	1.40	30	2.95	108	.....	.....
20	1.28	25	2.95	108	.....	.....
21	1.23	23	2.95	108	.....	.....
22	1.23	23	2.80	99	.....	.....
23	1.20	22	2.70	93	.....	.....
24	1.40	30	2.70	93	.....	.....
25	1.40	30	2.60	87	.....	.....
26	1.35	28	2.55	84	.....	.....
27	1.65	40	2.70	93	.....	.....
28	1.90	51	2.70	93	.....	.....
29	2.70	93	2.50	81	.....	.....
30	3.00	111	1.95	53	.....	.....
31	3.27	128	.....	.....	.....	.....

Ditch works damaged by flood, ditch not used after July 15.

MONTHLY DISCHARGE of Little Bow ditch from Highwood River, for 1916

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	2.00	Nil	0.71	.....	.....	44
February	40.00	1.02	13.40	.....	.....	771
March	21.00	5.00	12.50	.....	.....	769
April	22.00	6.00	11.60	.....	.....	690
May	128.00	22.00	43.00	.....	.....	2,644
June	130.00	53.00	103.00	.....	.....	6,129
July 1-16	46.00	3.20	17.50	.....	.....	555
The period	.....	.....	.....	.....	.....	11,602

MEAN MONTHLY DISCHARGE in Second-feet of Little Bow ditch from High River

MONTH	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	Mean in Sec.-ft.	Mean in Acre-ft.
October		6.50	68.0	24.0	10.1	2.80	22.0	1,367
November		10.10*b*	69.0	18.9	11.5	7.80	27.0	1,592
December				22.0	8.8	2.90	11.2	682
January			30.0	12.4	7.6	0.71	12.7	773
February			36.0	14.6	6.8	13.40	17.7	994
March	17.0*a*	14.90*c*	48.0	16.4	6.3	12.50	21.0	1,277
April	20.0	16.10	46.0	17.6	5.9	11.60	19.5	1,168
May	38.0	32.00	37.0	27.0	33.0	43.00	35.0	2,153
June	28.0	23.00	50.0	29.0	67.0	103.00	51.0	2,977
July	9.8	7.10	29.0	23.0	21.0	17.50*d*	18.0	1,110
August	9.2	0.11	26.0	15.1	9.2		11.9	739
September	9.6	19.60	27.0	10.7	3.4		14.1	854
Total in Acre-feet	7,177	6,890	28,203	13,934	11,504	12,416		15,686

a 26-31.
b 1-15.
c 21-31.
d 1-16.

HIGHWOOD RIVER AT HIGH RIVER

Location.—On the NW. ¼ Sec. 6, Tp. 19, Rge. 28, W. 4th Mer., at the new steel traffic bridge in the town of High River.

Records available.—May 28, 1908, to December 31, 1915.

Gauge.—Chain gauge: Elevation of zero of gauge was 3,381.66 during 1908-13. Elevation of zero of gauge was 3,379.74 during 1914-16.

Bench-mark.—Permanent iron bench-mark 128 feet N. 60° E. and SE. corner of stream, face of right abutment; elevation 3,389.60 feet, Canadian Pacific Railway Company's datum.

Channel.—Fairly permanent.

Discharge measurements.—From bridge.

Diversions.—The Little Bow ditch diverts water about one mile above the station.

Observer.—Philip Weinard.

Remarks.—This station was abandoned April 1, 1916. Records on this stream are continued near Aldersyde.

DISCHARGE MEASUREMENTS of Highwood River at High River, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 6	F. K. Beach	104	281	0.48	3.94*b*	136
Feb. 3	O. H. Hoover	100	244	0.21	4.02*b*	51
Mar. 6	S. H. Frame	95	253	0.39	3.70*b*	99
April 1	J. M. Paul	140	424	0.66	4.12	282
July 5	R. J. McGuinness	170	953	4.04	7.13	3,847

b Ice conditions.

Daily Gauge Height and Discharge of Highwood River at High River, for 1916

Day	January		February		March	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.68*b*	131	4.05	54	3.41	103
2	3.75	132	4.00	52	3.64	102
3	3.80	134	4.00	51	3.90	101
4	4.00	135	4.00	51	3.70	100
5	4.05	136	4.05	51	3.75	99
6	3.94	136	4.05	51	3.68	99
7	3.77	136	4.00	51	3.67	99
8	3.93	136	4.05	51	3.65	100
9	4.00	136	3.95	51	3.69	102
10	3.93	136	3.96	51	4.33	150
11	4.00	136	3.97	51	5.15	180
12	3.73	136	3.87	51	5.40	180
13	3.86	136	3.87	52	4.55	200
14	3.92	136	3.83	56	4.20*b*	280
15	3.90	136	3.77	90	4.05	230
16	4.00	135	6.14	500*e*	4.05	230
17	3.91	135	5.95	450*e*	4.07	240
18	3.85	134	5.10	400*e*	4.05	230
19	3.86	133	4.70	300*e*	4.00	220
20	3.80	132	4.28	280*e*	4.85	250*e*
21	3.82	129	4.15	260	4.85	250*e*
22	4.10	124	4.10	210	4.80	240*e*
23	3.80	118	4.05	160	4.10	235
24	4.00	104	3.85	124	4.05	230
25	3.95	90	3.76	114	3.85	180
26	3.95	82	3.75	111	4.05	230
27	4.00	75	3.56	109	4.05	230
28	4.05	68	3.63	107	4.05	230
29	4.00	64	3.61	105	4.00	220
30	4.05	60	.....	.....	4.00	220
31	4.05	56	.....	.....	4.10	235

b–b Ice conditions.
e Discharge estimated.

Monthly Discharge of Highwood River at High River, for 1916

(Drainage area 746 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	136	56	118	0.158	0.18	7,256
February	500	51	139	0.186	0.20	7,995
March	280	99	187	0.251	0.29	11,498
The period	.....	.....	.....	.....	0.67	26,749

MEAN MONTHLY DISCHARGE in Second-feet, of Highwood River at High River

MONTH	1907-8	1908-9	1909-10	1910-11	1911-12	1912-13	1913-14	1914-15	1915-16	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	221	146	*341	412	221	273	293	357	283	17,400
November	.....	.....	.....	.....	c186	d174	195	165	173	178	10,572
December	.....	.....	.....	.....	.....	.....	86	82	141	351	6,333
January	.....	.....	.....	.....	.....	.....	69	85	118	91	5,575
February	.....	.....	.....	.....	.....	.....	51	74	139	88	4,979
March	.....	.....	.....	105b	.....	.....	66	66	187	106	6,538
April	.....	187	258	182	300	318	264	255	.....	266	12,562
May	.....	1,568	856	790	732	768	880	1,968	.....	1,080	66,422
June	a4,164	2,652	953	1,844	1,275	1,478	1,209	2,879	.....	1,756	104,471
July	.....	1,516	*398	612	1,172	702	550	1,973	.....	989	60,823
August	342	548	*191	860	627	528	173	796	.....	508	31,166
September	196	224	*351	984	293	319	140	351	.....	357	21,252
Total in acre-feet	255,644	419,143	190,822	341,248	296,296	253,828	239,354	544,912	.....	.....	348,093

a 1-27.
* Includes Little Bow ditch.
b 22-31.
c 1-13.
d 1-23.

HIGHWOOD RIVER NEAR ALDERSYDE

Location.—On NW. ¼ Sec. 17, Tp. 20, Rge. 28, W. 4th Mer., at L. W. Barret's ranch about three miles northeast of Aldersyde.

Records available.—From October 3, 1911, to December 31, 1916.

Gauge.—Standard chain gauge. The elevation of zero has been maintained at 90.64 feet since establishment.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—Probably permanent. Large stones and boulders in and near section.

Discharge measurements.—From traffic bridge or by wading.

Observer.—L. W. Barret.

DISCHARGE MEASUREMENTS of Highwood river near Aldersyde, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 5	J. M. Paul	95	236	1.99	1.98	470
May 6	W. M. Edwards	172	396	3.15	2.45	1,250
May 31	do	220	739	4.70	3.89	3,470
June 20	R. J. McGuinness	233	1,146	6.24	5.64	7,144
June 24	do	224	719	5.18	4.00	3,728
July 5	do	224	766	5.54	4.42	4,248
July 28	W. M. Edwards	173	351	2.93	2.24	1,030
Aug. 24	do	192	419	3.47	2.68	1,457
Oct. 23	W. H. Hannan	153	282	2.10	1.84	593
Dec. 1	W. M. Edwards	150	343	0.62	2.82b	211
Dec. 18	do	139	237	0.70	2.70b	165

b Ice conditions.

Daily Gauge Height and Discharge of Highwood river near Aldersyde, for 1916

Day	March		April		May		June		July	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.69	120*e*	2.23	450	2.14	907	4.17	3,946	4.38	4,337
2	2.67	135	3.21	330	2.17	938	3.90	3,460	5.34	6,396
3	2.70	150	2.79	400	2.04	805	4.10	3,820	.....	5,812
4	2.75	165	2.62	450	2.13	896	4.73	5,038	4.82	5,228
5	2.77	180	1.98	470*e*	2.27	1,047	5.30	6,300	4.20	4,000
6	2.75	195	1.56	385	2.44	1,245	4.93	5,464	4.06	3,748
7	2.73	210	1.64	447	2.52	1,346	4.35	4,299	3.81	3,302
8	2.75	225	1.70	495	2.57	1,411	4.00	3,640	3.73	3,166
9	2.81	230	1.68	479	2.36	1,149	4.35	4,280	3.82	3,320
10	2.84	250	1.65	455	2.28	1,058	4.45	4,472	3.72	3,149
11	4.42	200	1.66	463	2.24	1,014	4.15	3,910	3.45	2,692
12	4.38	210	1.64	447	2.10	865	3.78	3,251	3.33	2,498
13	4.05	220	1.58	400	2.06	825	3.70	3,115	3.12	2,175
14	3.69	230	1.56	385	2.04	805	3.74	3,183	3.08	2,116
15	3.66	240	1.60	415	2.02	785	4.45	4,472	2.93	1,898
16	3.61	250	1.69	487	2.06	825	5.42	6,589	2.80	1,715
17	3.54	260	1.67	471	2.07	835	5.80	7,550	2.76	1,661
18	3.43	270	1.64	447	2.05	815	5.75	7,420	2.48	1,295
19	3.23	280	1.62	431	2.08	845	6.03	8,186	2.69	1,567
20	3.15	290	1.56	385	2.18	949	5.64	7,137	2.61	1,463
21	3.32	280	1.53	362	2.27	1,047	5.10	5,835	2.53	1,359
22	3.57	270	1.51	348	2.30	1,080	4.96	5,529	2.45	1,258
23	3.06	290	1.51	348	2.33	1,114	4.28	4,148	2.43	1,232
24	2.94	310	1.50	340	2.42	1,220	4.00	3,640	2.33	1,114
25	.....	300	1.48	326	2.44	1,245	3.90	3,460	2.27	1,047
26	3.23	320	1.53	362	2.48	1,296	4.13	3,874	2.29	1,069
27	2.55	340	1.66	463	2.45	1,258	4.82	5,228	2.37	1,160
28	2.57	360	1.85	625	2.61	1,463	5.96	7,988	2.24	1,014
29	2.43	380	2.06	825	3.35	2,530	6.68	10,232	2.18	949
30	2.44	400	2.05	815	3.87	3,408	5.48	6,736	2.10	865
31	2.41	420	.....	.....	3.89	3,442	.....	.....	2.07	835

e-e Discharge estimated during breakup from field inspection.

DAILY GAUGE HEIGHT AND DISCHARGE of Highwood river near Aldersyde, for 1916—*Concluded*

Day	August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.05	815	2.12	886	1.84	616	1.66	463	2.82	1,743
2	2.03	795	2.07	835	1.85	625	1.68	479	3.52*b*	209
3	2.00	765	2.04	805	1.83	607	1.67	471	3.56	207
4	1.97	736	2.51	1,333	1.78	563	1.66	463	3.67	204
5	2.04	805	3.27	2,404	1.75	538	1.64	447	3.49	202
6	2.02	785	3.06	2,087	1.86	634	1.65	455	3.45	199
7	1.94	708	2.56	1,398	1.95	718	1.64	447	3.34	197
8	1.82	598	2.34	1,126	1.87	643	1.42	284	3.02	195
9	2.00	765	2.26	1,036	1.82	598	1.37	249	2.60	191
10	2.43	1,232	2.21	981	1.80	580	1.39	263	2.51	189
11	2.30	1,080	2.17	938	1.78	563	1.44	298	2.34	187
12	2.13	896	2.08	845	1.77	554	1.46	312	2.46	184
13	2.00	765	2.05	815	1.75	538	1.42	284	2.37	180
14	1.93	698	2.05	815	1.75	538	1.38	256	2.90	177
15	1.88	652	2.03	795	1.77	554	1.84	616	2.74	175
16	1.84	616	2.01	775	1.78	563	1.93	698	2.71	172
17	.....	860*e*	1.98	746	1.80	580	1.91	680	2.74	169
18	2.32	1,103	1.94	708	1.86	634	1.87	643	2.67	165
19	6.05	8,242	1.90	670	1.80	580	1.45	305	2.58	163
20	3.31	2,466	1.86	634	1.78	563	1.92	689	2.62	159
21	2.79	1,702	1.82	598	1.80	580	1.98	746	2.49	156
22	2.61	1,463	1.80	580	1.91	680	1.76	546	2.34	153
23	2.57	1,411	1.77	554	1.82	598	1.74	529	2.32	149
24	2.70	1,580	1.76	546	1.85	625	1.90	670	2.30	147
25	2.55	1,385	1.75	538	1.87	643	1.87	643	2.54	144
26	2.49	1,308	1.75	538	1.86	634	1.77	554	2.33	141
27	2.34	1,126	1.79	572	1.83	607	1.79	572	2.47	139
28	2.30	1,080	1.77	554	1.81	589	1.96	727	2.42	137
29	2.30	1,080	1.74	529	1.72	512	2.04	805	2.45	135
30	2.28	1,058	1.72	512	.....	496*e*	2.57	1,411	2.59	134
31	2.15	918	.....	.....	.....	480*e*	.....	.....	2.61*b*	134

b–b Ice conditions.
e Discharge estimated.

MONTHLY DISCHARGE of Highwood river near Aldersyde, for 1916

(Drainage area 883 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March	420	120	257	0.291	0.34	15,802
April	825	326	450	0.510	0.57	26,777
May	3,442	785	1,241	1.400	1.61	76,288
June	10,232	3,115	5,207	5.900	6.58	309,705
July	6,396	835	2,369	2.680	3.09	145,629
August	8,242	598	1,274	1.440	1.66	78,317
September	2,404	512	872	0.988	1.10	51,888
October	718	512	588	0.666	0.77	36,155
November	1,411	249	534	0.605	0.68	31,775
December	1,743	134	220	0.249	0.29	13,527
The period	.....	.....	.....	.....	16.69	785,863

MEAN MONTHLY DISCHARGE in Second-feet of Highwood river near Aldersyde

MONTH	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October		270	322	302	422	588	381	23,419
November						534	534	31,775
December						220	220	13,527
January								
February								
March				76*c*	257		257	15,802
April		511*b*	262	257	450		323	19,220
May		720	884	2,099	1,241		1,236	75,993
June	1,692	1,703	1,300	3,382	5,207		2,657	158,061
July	1,642	1,060	642	2,406	2,369		1,624	99,834
August	751	406	187	1,000	1,274		724	44,485
September	347*a*	324	149	462	872		452	26,881
Total in acre-ft.	260,160	287,872	226,939	603,361	730,354			508,997

a 13-30.
b 15-30.
c 17-31.

CANADIAN PACIFIC RAILWAY COMPANY CANAL (NORTH BRANCH) NEAR BASSANO

Location.—On NW. ¼ Sec. 3, Tp. 21, Rge. 18, W. 4th Mer., about three miles southeast of the town of Bassano, and about three and one-half miles east of the Bassano dam.

Records available.—From May 1, 1914, to November 4, 1916.

Gauge.—Vertical staff in stilling box; zero of gauge is at elevation of floor of rating flume at measuring section, 90.54 feet.

Bench-mark.—Top of left abutment of gauging bridge, assumed elevation 100.00 feet.

Channel.—Permanent concrete section.

Discharge measurements.—From gauging bridge or by wading underneath.

Winter flow.—Ditch closed off at freeze-up.

Artificial control.—Discharge at station may be affected by the operation of the headgates about 400 feet above the station.

Co-operation.—Gauge heights supplied by Canadian Pacific Railway Company. The Company also furnishes the results of their gaugings.

DISCHARGE MEASUREMENTS of Canadian Pacific Railway Company canal (N. Branch) near Bassano, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
May 16	Canadian Pacific Railway	32.8	27.9	1.10	0.90	31.0
May 18	H. C. Ritchie	34.0	46.5	1.34	1.44	62.0
June 8	do	31.5	23.8	0.93	0.70	23.0
June 14	Canadian Pacific Railway	31.4	16.7	0.93	0.55	15.4
June 28	do do do	34.6	43.1	1.53	1.35	66.0
July 10	H. C. Ritchie	32.0	24.0	1.23	0.71	31.0
July 13	Canadian Pacific Railway	30.8	12.0	1.18	0.40	14.1
July 18	L. E. Kendall	32.0	21.6	1.14	0.70	25.0
Aug. 1	H. C. Ritchie	33.5	34.4	1.33	1.04	46.0
Aug. 7	Canadian Pacific Railway	33.4	32.9	1.22	1.05	40.0
Aug. 21	H. C. Ritchie	31.0	17.7	0.98	0.60	17.2
Sept. 11	Canadian Pacific Railway	32.6	26.3	1.33	0.85	35.0
Sept. 12	H. C. Ritchie	32.0	24.0	1.09	0.74	26.0
Oct. 11	do	30.0	11.8	0.76	0.36	9.0
Oct. 17	Canadian Pacific Railway	33.0	29.6	1.40	0.95	41.0
Nov. 2	H. C. Ritchie	31.0	14.8	0.93	0.49	13.7
Nov. 4	Canadian Pacific Railway	31.2	15.1	1.06	0.50	16.0

DAILY GAUGE HEIGHT AND DISCHARGE of Canadian Pacific Railway Company canal (N. Branch) near Bassano, for 1916

DAY	May		June		July	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	0.80	28	0.65	21.0	1.35	63.0
2	0.80	28	0.65	21.0	1.30	59.0
3	0.80	28	0.65	21.0	1.30	59.0
4	0.90	34	0.65	21.0	0.80	28.0
5	0.90	34	0.70	23.0	0.80	28.0
6	1.20	52	0.65	21.0	0.80	28.0
7	0.90	34	0.65	21.0	0.75	26.0
8	0.80	28	0.65	21.0	0.70	23.0
9	0.90	34	0.65	21.0	0.65	21.0
10	0.90	34	0.65	21.0	0.60	18.3
11	0.90	34	0.65	21.0	0.40	10.4
12	0.80	28	0.65	21.0	0.40	10.4
13	0.80	28	0.65	21.0	0.40	10.4
14	0.80	28	0.55	16.2	0.40	10.4
15	0.80	28	0.45	12.2	0.40	10.4
16	0.80	28	1.00	40.0	0.40	10.4
17	0.90	34	1.00	40.0	0.40	10.4
18	1.30	59	1.00	40.0	0.40	10.4
19	1.30	59	1.30	59.0	0.60	18.3
20	1.30	59	1.30	59.0	0.60	18.3
21	1.30	59	1.35	63.0	0.80	28.0
22	1.30	59	1.35	63.0	0.80	28.0
23	1.30	59	1.35	63.0	0.80	28.0
24	1.35	63	1.35	63.0	0.80	28.0
25	1.30	59	1.35	63.0	0.80	28.0
26	1.25	55	1.35	63.0	0.75	26.0
27	1.25	55	1.35	63.0	0.80	28.0
28	1.25	55	1.35	63.0	0.75	26.0
29	1.25	55	1.35	63.0	0.75	26.0
30	0.80	28	1.35	63.0	0.80	28.0
31	0.80	28	.....	.....	0.60	18.3

Head-gates opened May 1.

DAILY GAUGE HEIGHT AND DISCHARGE of Canadian Pacific Railway Company canal (N. Branch) near Bassano, for 1916—*Concluded*

DAY	August		September		October		November	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.00	40.0	0.30	7.3	0.40	10.4	0.55	16.1
2	0.85	31.0	0.40	10.4	0.35	8.9	0.60	18.3
3	1.20	52.0	0.40	10.4	0.30	7.3	0.60	18.3
4	1.20	52.0	0.40	10.4	0.30	7.3	0.60	18.3
5	1.20	52.0	0.40	10.4	0.40	10.4	.....	.....
6	1.20	52.0	0.60	18.3	0.40	10.4	.....	.....
7	1.20	52.0	0.60	18.3	0.40	10.4	.....	.....
8	1.20	52.0	0.70	23.0	0.40	10.4	.....	.....
9	0.70	23.0	0.70	23.0	0.20	4.6	.....	.....
10	0.65	21.0	0.85	31.0	0.20	4.6	.....	.....
11	0.60	18.3	0.80	28.0	0.20	4.6	.....	.....
12	0.60	18.3	0.70	23.0	0.20	4.6	.....	.....
13	0.60	18.3	0.55	16.1	0.20	4.6	.....	.....
14	0.60	18.3	0.40	10.4	0.20	4.6	.....	.....
15	0.60	18.3	0.38	9.8	0.90	34.0	.....	.....
16	0.60	18.3	0.35	8.9	0.90	34.0	.....	.....
17	0.60	18.3	0.30	7.3	0.90	34.0	.....	.....
18	0.60	18.3	0.50	14.0	1.00	40.0	.....	.....
19	0.60	18.3	0.50	14.0	1.05	43.0	.....	.....
20	0.40	10.4	0.50	14.0	0.90	34.0	.....	.....
21	0.60	18.3	0.45	12.2	0.90	34.0	.....	.....
22	0.40	10.4	0.45	12.2	0.50	14.0	.....	.....
23	0.50	14.0	0.43	11.5	0.50	14.0	.....	.....
24	0.70	23.0	0.45	12.2	0.50	14.0	.....	.....
25	1.10	46.0	0.48	13.3	0.55	16.1	.....	.....
26	1.10	46.0	0.40	10.4	0.50	14.0	.....	.....
27	1.10	46.0	0.40	10.4	0.50	14.0	.....	.....
28	1.10	46.0	0.48	13.3	0.45	12.2	.....	.....
29	0.40	10.4	0.30	7.3	0.50	14.0	.....	.....
30	0.40	10.4	0.30	7.3	0.50	14.0	.....	.....
31	0.40	10.4	.....	.....	0.50	14.0	.....	.....

Head-gates closed Nov 4.

MONTHLY DISCHARGE of Canadian Pacific Railway Company canal (N. Branch) near Bassano, for 1916

MONTH	DISCHARGE IN SECOND-FEET			Total Discharge in acre-ft
	Maximum	Minimum	Mean	
May	63.0	28.0	42.0	2,582
June	63.0	12.2	39.0	2,321
July	63.0	10.4	25.0	1,537
August	52.0	10.4	28.0	1,722
September	31.0	7.3	13.9	827
October	43.0	4.6	16.0	983
November (1-4)	18.3	16.1	17.8	141
The period	.....	.....	.....	10,113

CANADIAN PACIFIC RAILWAY COMPANY CANAL (EAST BRANCH) NEAR BASSANO

Location.—On SE. ¼ Sec. 3, Tp. 21, Rge. 18, W. 4th Mer., about four hundred feet from headgates of East Branch and about three and one-half miles east of the Bassano dam.

Records available.—May 28, 1914, to December 31, 1916.

Gauge.—Vertical staff in stilling box; zero of gauge is at elevation of floor of rating flume at measuring section, 87.67 feet.

Bench-mark.—Top of left abutment of gauging bridge; assumed elevation 100.00 feet.

Channel.—Permanent concrete section.

Discharge measurements.—From gauging bridge or by wading below.

Winter flow.—Water was diverted in January and February into this ditch in order to fill the reservoir at Lake Newell.

Artificial control.—Discharge may be affected by the operation of the headgates above station.

Co-operation.—Gauge heights supplied by the Canadian Pacific Railway Company, and Company also furnishes results of their gaugings.

DISCHARGE MEASUREMENTS of Canadian Pacific Railway Company canal (East Branch) near Bassano, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 4	Canadian Pacific Railway Co.	80.5	176.4	1.01	2.70	179.0
Jan. 12	F. K. Beach	76.0	224.0	1.00	3.49	224.0
Jan. 21	Canadian Pacific Railway Co.	80.5	186.6	1.06	2.70	197.0
Mar. 12	E. J. Switzer	72.0	101.0	0.79	1.38	79.0*x*
April 6	H. C. Ritchie	68.0	10.9	0.93	0.20	10.1*x*
May 18	do	74.0	127.0	1.12	1.82	142.0
June 8	do	70.0	46.3	0.70	0.68	33.0
June 14	Canadian Pacific Railway Co.	72.9	57.0	1.11	0.80	63.0
July 10	H. C. Ritchie	71.0	79.0	0.74	1.15	58.0
July 13	Canadian Pacific Railway Co.	74.3	82.8	0.68	1.15	57.0
Aug. 1	H. C. Ritchie	72.0	85.0	0.73	1.21	62.0
Aug. 7	Canadian Pacific Railway Co.	74.4	84.3	0.68	1.17	68.0
Aug. 21	H. C. Ritchie	71.5	72.6	0.66	1.08	48.0
Sept. 12	do	72.0	75.3	0.64	1.08	48.0
Sept. 16	Canadian Pacific Railway Co.	75.0	96.2	1.18	1.33	113.0
Oct. 11	H. C. Ritchie	72.0	83.6	0.68	1.19	57.0
Oct. 17	Canadian Pacific Railway Co.	75.5	105.3	1.22	1.45	128.0
Nov. 2	H. C. Ritchie	71.0	61.0	0.47	0.90	29.0
Nov. 4	Canadian Pacific Railway Co.	72.5	49.8	0.62	0.70	31.0
Nov. 8	Canadian Pacific Railway Co.	78.5	163.0	1.37	2.20	223.0
Nov. 22	H. C. Ritchie	69.0	37.8	1.43	0.55	54.0

x Head-gates closed; melting snow and ice.

DAILY GAUGE HEIGHT AND DISCHARGE of Canadian Pacific Railway Company canal (E. Branch) near Bassano, for 1916

	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.90	150	3.40	240	.....	.....	....	.....	0.87	55	1.28	93
2	2.90	150	3.40	258	.....	.....	.....	.....	0.87	55	1.28	93
3	2.90	153	3.50	280	.....	.....	.....	.....	0.87	55	1.28	93
4	2.95	163	3.60	304	.....	.....	.....	.....	0.87	55	1.28	93
5	3.00	179	3.70	316	.....	.....	.....	.....	0.87	55	1.28	93
6	3.20	194	3.20	280	.....	.....	.....	.....	0.87	55	1.28	93
7	3.35	207	2.90	190	.....	.....	.....	.....	0.87	55	0.58	33
8	3.40	214	2.60	137	.....	.....	.....	.....	0.67	39	0.59	33
9	3.50	220	2.60	123	.....	.....	.....	.....	0.57	32	0.59	33
10	3.50	224	2.60	105	.....	.....	.....	.....	0.47	25	0.59	33
11	3.50	225	2.50	98	.....	.....	.....	.....	0.37	19	0.59	33
12	3.50	224	2.80	170	.....	.....	.....	.....	1.07	72	0.59	33
13	3.10	180	2.60	136	.....	.....	.....	.....	0.97	63	0.59	33
14	3.00	170	2.80	170	.....	.....	.....	.....	0.97	63	0.79	48
15	3.00	170	3.00	230	.....	.....	.....	.....	1.07	72	0.79	48
16	3.00	170	3.40	370	.....	.....	.....	.....	1.32	97	0.79	48
17	3.00	170	3.60	450	.....	.....	.....	.....	1.57	127	0.79	48
18	3.00	172	3.60	462	.....	.....	.....	.....	0.97	63	0.79	48
19	3.10	178	3.60	462	.....	.....	.....	.....	0.37	19	0.79	48
20	3.10	184	3.60	450	.....	.....	.....	.....	0.87	55	0.89	56
21	3.20	198	2.80	210	.....	.....	.....	.....	1.77	155	0.79	48
22	3.20	230	3.50	375	.....	.....	.....	.....	1.57	127	0.69	40
23	3.20	256	3.50	385	.....	.....	.....	.....	1.37	103	0.59	33
24	3.30	262	3.50	380	.....	.....	.....	.....	1.37	103	0.49	26
25	3.35	263	3.00	300	.....	.....	.....	.....	1.37	103	0.59	33
26	3.30	220	2.80	180	.....	.....	.....	.....	1.37	103	0.99	65
27	3.20	220	2.40	50	.....	.....	.....	.....	1.37	103	0.99	65
28	3.30	235	2.40	35	.....	.....	.....	.....	1.37	103	1.09	74
29	3.20	216	.....	.....	.....	.....	.....	.....	1.38	104	1.14	79
30	3.20	210	.....	.....	.....	.....	.....	.....	1.28	93	1.14	79
31	3.20	212	.....	.....	.....	.....	.....	.....	1.28	93	.....	.....

Head-gates closed March 1 to April 30.

DAILY GAUGE HEIGHT AND DISCHARGE of Canadian Pacific Railway Company canal (E. Branch) near Bassano, for 1916.—*Concluded*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.15	80	1.10	75	0.57	32	0.88	55	0.88	55	0.37	19
2	1.15	80	1.10	75	0.52	28	0.93	60	1.23	88	0.87	55
3	1.15	80	1.20	85	1.15	80	0.88	55	1.18	83	.....	.....
4	1.10	75	1.20	85	1.15	80	0.68	40	1.18	83	.....	.....
5	1.10	75	1.20	85	1.17	82	0.68	40	1.28	93	.....	.....
6	1.10	75	1.10	75	1.12	77	0.78	47	1.38	104	.....	.....
7	1.10	75	1.10	75	0.95	62	1.18	83	1.28	93	.....	.....
8	1.10	75	1.10	75	1.02	68	1.58	128	2.08	204	.....	.....
9	1.10	75	0.90	57	1.07	72	1.49	117	1.98	188	.....	.....
10	1.10	75	1.30	95	1.04	70	1.54	123	1.38	104	.....	.....
11	1.10	75	1.29	94	1.29	94	1.59	130	1.18	83	.....	.....
12	1.10	75	0.89	56	1.61	132	1.59	130	0.98	64	.....	.....
13	1.15	80	1.09	74	1.56	126	1.59	130	0.28	14	.....	.....
14	1.15	80	1.19	84	1.61	132	1.59	130	0.28	14	.....	.....
15	1.15	80	1.24	89	1.61	132	2.04	197	0.58	33	.....	.....
16	1.15	80	1.09	74	1.29	94	1.49	117	0.83	51	.....	.....
17	1.15	80	1.14	79	2.06	201	2.04	197	0.68	40	.....	.....
18	1.15	80	0.54	30	2.51	276	1.49	117	0.58	33	.....	.....
19	1.15	80	0.99	65	1.46	113	1.29	94	0.58	33	.....	.....
20	1.15	80	1.04	70	1.11	76	1.24	89	0.57	32	.....	.....
21	1.15	80	1.06	71	1.02	68	1.29	94	0.72	43	.....	.....
22	1.15	80	1.08	73	1.02	68	1.49	117	0.77	47	.....	.....
23	1.15	80	1.06	71	1.12	77	1.49	117	0.37	19	.....	.....
24	1.10	75	1.20	85	1.22	87	1.49	117	0.37	19	.....	.....
25	1.15	80	1.08	73	0.97	63	1.44	111	0.57	32	.....	.....
26	1.10	75	1.23	88	1.22	87	1.29	94	0.57	32	.....	.....
27	1.15	80	1.16	81	1.17	82	1.04	70	0.52	28	.....	.....
28	1.10	75	1.13	78	0.82	51	0.99	65	0.27	14	.....	.....
29	1.10	75	1.23	88	1.07	72	0.49	26	0.42	22	.....	.....
30	1.10	75	1.28	93	1.07	72	0.59	33	0.47	25	.....	.....
31	1.10	75	0.76	46	.....	.....	0.73	43	.....	.....	.....	.....

Head-gates closed December 3-31

MONTHLY DISCHARGE of Canadian Pacific Railway Company canal (East Branch) near Bassano, for 1916

MONTH	DISCHARGE IN SECOND-FEET			Total Discharge in Acre-ft
	Maximum	Minimum	Mean	
January	263	150	201	12,359
February	462	35	255	14,162
March	.....	.....	.....	.....
April	.....	.....	.....	.....
May	155	19	75	4,612
June	93	26	56	3,332
July	80	75	78	4,796
August	95	30	75	4,612
September	276	28	92	5,474
October	197	26	96	5,903
November	204	14	59	3,511
December (1-2)	55	9	37	147
The period	.....	.....	.....	58,908

BOW RIVER NEAR BASSANO

Location.—On SE. ¼ of Sec. 2, Tp. 21, Rge. 19, W. 4th Mer., about one-half mile down stream from Canadian Pacific Railway Company's dam, and about three miles southwest of the town of Bassano.

Records available.—August 20, 1909, to December 31, 1916.

Gauge.—Vertical staff, on left bank at gauging station. Elevation of zero of gauge 2,519.43 feet during 1909-10; elevation of zero of gauge 2,517.90 feet during 1911-12; elevation of zero of gauge 2,513.60 feet during 1913; elevation of zero of gauge 2,510.68 feet during 1914-16.

Bench-mark.—Permanent iron bench-mark, elevation 2,524.29 feet (Canadian Pacific Railway Company's datum).

Channel.—Permanent.

Discharge measurements.—Made from a cable.

Winter flow.—Records taken during winter season.

Diversions.—Water for the Eastern Section of Canadian Pacific Railway Company's irrigation tract is diverted about one-half mile up stream.

Co-operation.—Gauge heights supplied by Canadian Pacific Railway Company.

DISCHARGE MEASUREMENTS of Bow river near Bassano, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec*	*Feet*	*Sec.-ft.*
Feb. 10	J. M. Paul	484	1,582	0.80	3.71	1,270
Mar. 11	E. J. Switzer	30	.....	.....	0.05	20*e*
Mar. 12	do	585	2,462	1.61	3.52	3,978
April 6	H. C. Ritchie	600	3,055	2.62	4.69	8,000*e*
April 27	do	600	3,055	2.62	4.69	8,000*e*
May 19	do	585	2,514	1.51	3.26	3,800
June 8	do	622	4,515	4.05	6.60	18,284
June 8	W. H. Storey	622	4,603	4.06	6.60	18,688*x*
June 22	L. E. Kendall	620	7,106	6.24	10.87	44,340*x*
June 23	do	620	6,862	6.08	10.47	41,738
June 24	do	618	5,697	5.52	8.60	31,470
June 27	do	618	5,392	5.28	8.08	28,470
July 11	H. C. Ritchie	620	5,518	5.46	8.16	30,147
Aug. 2	do	598	3,411	2.68	4.76	9,146
Aug. 22	do	610	4,396	3.88	6.31	17,055
Sept. 12	do	605	3,801	2.92	5.24	11,102
Oct. 11	do	596	2,888	1.89	3.87	5,460
Nov. 2	do	595	2,698	1.63	3.54	4,394
Nov. 23	do	530	.....	.....	3.28	3,800*e*
Dec. 12	W. K. Broughton	520	2,100	0.80	2.03	1,680*e*

e Estimated discharge
x Slope measurement.
Pool at dam was being filled on Mar. 11.

Daily Gauge Height and Discharge of Bow river near Bassano, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.65*b*	920	3.40	1,180	2.55	1,300		2,750		2,940	7.56	24,317
2	1.55	950	3.40	1,190	2.45	1,300		2,800		3,250	7.46	23,689
3	1.55	960	3.45	1,190	2.45	1,300		3,150		3,040	6.66	18,760
4	1.55	995	3.45	1,190	2.45	1,300		3,400		3,620	7.16	21,805
5	1.65	990	3.55	1,195	2.40	1,300		3,380		4,070	7.56	24,317
6	1.75	990	3.65	1,200	2.35	1,330		3,300		4,050	7.66	24,945
7	1.95	995	3.75	1,230	2.25	1,360		3,350		4,300	6.96	20,560
8	2.15	1,005	3.75	1,250	2.35	1,400		3,050		4,550	6.58	18,280
9	2.35	1,035	3.80	1,260	2.60	1,500		3,110		5,160	6.51	17,860
10	2.55	1,055	3.71	1,260	2.40*b*	1,560		3,200		4,800	6.56	18,160
11	2.75	1,080	3.75	1,290		1,620*e*		3,240		4,810	6.86	19,960
12	2.75	1,100	3.75	1,310		1,660		3,220		4,200	7.66	24,945
13	2.70	1,130	3.75	1,290		1,800		3,170		4,110	7.96	26,829
14	2.55	1,140	3.85	1,250		1,800		3,020		3,940	8.06	27,457
15	2.55	1,070	3.75	1,150		1,900		3,030		3,910	8.15	28,022
16	2.55	970	3.60	1,050		1,920		3,040		3,840*e*	8.35	29,278
17	2.55	850	3.55	980		1,940		3,000	3.37	3,625	8.15	28,022
18	2.55	760	3.75	970		1,960		3,090	3.35	3,575	8.35	29,278
19	2.60	695	4.25	1,000		2,050		2,880	3.32	3,500	9.97	39,442
20	2.55	670	3.80	1,250		2,200		2,910	3.24	3,300	10.37	41,954
21	2.75	700	3.60	1,080		2,350		2,810	3.67	4,410	10.27	41,326
22	2.70	750	3.00	1,050		2,400		2,740	3.72	4,560	10.87	45,094
23	2.65	900	2.80	1,045		2,430		2,760	3.77	4,710	9.77	38,186
24	3.15	1,070	3.10	1,030		2,450		2,740	3.87	5,045	8.85	32,418
25	3.20	1,120	2.90	1,010		2,500		2,530	4.02	5,570	8.05	27,394
26	3.20	1,130	2.90	1,110		2,520		2,510	4.07	5,745	7.95	26,766
27	3.20	1,140	2.60	1,250		2,550		2,360	4.27	6,480	8.00	27,080
28	3.25	1,145	2.70	1,270		2,600		2,380	4.67	8,115	9.77	38,186
29	3.30	1,150	2.80	1,300		2,660		2,370	4.97	9,465	11.67	50,118
30	3.35	1,160				2,720		2,830	7.26	22,433	10.87	45,094
31	3.35	1,175				2,750			7.21	22,119		

b-b Ice conditions.

e Discharge estimated from March 11 to May 16; estimates are based on a study of the discharge records of the Bow and Elbow rivers at Calgary, Highwood river at Aldersyde, Sheep river at Okotoks, and smaller tributaries. No gauge height records, because of repair work at dam.

DAILY GAUGE HEIGHT AND DISCHARGE of Bow river near Bassano, for 1916—*Concluded*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	10.47	42,582	4.98	9,510	5.06	9,870	3.88	5,080	3.63	4,290	2.79	2,160
2	9.77	38,186	4.88	9,060	5.06	9,870	3.98	5,430	3.58	4,150	2.79	2,140
3	9.07	33,790	4.73	8,385	5.16	10,320	4.08	5,780	3.48	3,900	2.79	2,120
4	10.07	40,070	5.48	11,940	5.26	10,800	3.98	5,430	3.43	3,775	2.69	2,100
5	9.87	38,814	5.18	10,410	7.76	25,573	3.88	5,080	3.38	3,650	2.69	2,060
6	9.07	33,790	4.78	8,610	7.46	23,689	3.88	5,080	3.38	3,650	2.69	2,040
7	8.86	32,481	4.88	9,060	7.16	21,805	3.88	5,080	3.38	3,650	2.59	2,020
8	7.86	26,201	4.77	8,565	6.26	16,360	3.68	4,440	3.33	3,525	2.59	2,000
9	7.86	26,201	4.67	8,115	5.96	14,580	3.38	3,650	3.18	3,160	2.59	1,980
10	8.16	28,085	4.77	8,565	5.67	12,985	4.68	8,160	3.09	2,980	2.39	1,650
11	8.11	27,771	5.47	11,885	5.52	12,160	4.13	5,955	3.18*b*	2,910	1.99	1,210
12	7.96	26,829	5.67	12,985	5.37	11,350	3.58	4,150	2.58	2,010	1.89	1,160
13	7.76	25,573	5.27	10,850	4.37	6,880	3.58	4,150	2.08	1,330	1.85	1,190
14	7.56	24,317	5.06	9,870	4.87	9,015	3.48	3,900	2.18	1,400	1.95	1,280
15	7.56	24,317	4.76	8,520	5.12	10,140	3.28	3,400	2.28	1,600	2.35	1,480
16	6.96	20,560	4.76	8,520	5.17	10,365	3.58	4,150	2.38	1,750	2.55	1,780
17	6.81	19,660	4.66	8,070	5.07	9,915	3.68	4,440	2.78	2,350	2.65	2,000
18	6.66	18,760	4.76	8,520	5.17	10,365	3.88	5,080	2.88	2,500	2.75	2,040
19	6.76	19,360	4.56	7,640	4.67	8,115	3.78	4,740	2.88	2,550	2.95	2,030
20	7.01	20,863	9.45	36,186	4.47	7,280	3.58	4,150	3.08	2,850	2.95	2,000
21	6.57	18,220	8.55	30,534	4.42	7,080	3.68	4,440	3.18	2,960	3.15	1,980
22	6.37	17,020	6.35	16,900	4.37	6,880	3.68	4,440	3.33	2,990	3.15	1,970
23	5.97	14,635	5.95	14,525	4.07	5,745	3.48	3,900	3.28	2,980	3.55	1,960
24	5.77	13,535	5.75	13,425	4.17	6,095	3.58	4,150	3.18	2,930	3.35	1,950
25	5.67	12,985	5.95	14,525	4.17	6,095	3.38	3,650	2.98	2,790	3.15	1,930
26	5.57	12,435	5.85	13,975	4.07	5,745	4.10*a*	5,850	2.98	2,550	2.95	1,860
27	5.52	12,160	5.75	13,425	3.97	5,395	4.68	8,160	2.78	2,290	3.25	1,780
28	5.47	11,885	5.55	12,325	3.87	5,045	4.48	7,320	2.88	2,280	3.55	1,650
29	5.47	11,885	5.35	11,250	3.87	5,045	3.98	5,430	2.78	2,230	3.35	1,550
30	5.33	11,150	5.25	10,750	3.77	4,710	3.68	4,440	2.78	2,190	3.25	1,530
31	5.18	10,410	4.95	9,375	.....	.....	3.58	4,150	.....	.....	3.08*b*	1,550

a Gauge height interpolated
b-b Ice conditions.

MONTHLY DISCHARGE of Bow river near Bassano, for 1916

(Drainage area 7,838 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	1,175	670	994	0.127	0.15	61,119
February	1,310	970	1,167	0.149	0.16	67,127
March	2,750	1,300	1,949	0.249	0.29	119,839
April	3,400	2,360	2,937	0.375	0.42	174,764
May	22,433	2,940	5,717	0.729	0.84	351,525
June	50,118	17,860	29,318	3.740	4.17	1,744,542
July	42,582	10,410	23,049	2.941	3.39	1,417,228
August	36,186	7,640	12,138	1.549	1.79	746,336
September	25,573	4,710	10,309	1.315	1.46	613,428
October	8,160	3,400	4,944	0.631	0.73	303,994
November	4,290	1,330	2,806	0.358	0.40	166,969
December	2,160	1,160	1,811	0.231	0.27	111,354
The year	.....	.....	.....	.....	14.07	5,878,225

MISCELLANEOUS DISCHARGE MEASUREMENTS made in Bow river drainage basin, in 1916

Date	Engineer	Stream	Location	Width	Area of Section	Mean Velocity	Discharge
				Feet	*Sq. ft.*	*Ft. per sec.*	*Sec.-ft.*
July 26	Kendall and McGuinness	Can. Pac. Ry. Co. Canal at Antelope creek, syphon	SE. 8-18-16-4	36.8	27.80	0.84	23.00
July 22	H. C. Ritchie	Beaupre creek	SE. 15-26-5-5	13.0	13.90	1.40	19.40
Aug. 8	do	do	do	12.0	3.60	0.83	3.00
Sept. 22	do	do	do	16.0	8.40	1.01	8.40
July 22	do	Bighill creek	SW. 10-26-4-5	19.0	19.20	2.85	55.00
Aug. 8	do	do	do	19.0	15.00	2.55	38.00
Sept. 28	do	do	do	21.0	17.60	2.34	41.00
July 27	W. M. Edwards	Fish creek (N. Br.)	NE. 22-22-3-5	29.0	29.10	1.08	31.00
Aug. 26	do	do do	do	28.0	25.60	1.43	37.00
Oct. 25	W. H. Hannan	do do	do	30.0	29.15	1.39	41.00
July 27	W. M. Edwards	do (S. Br.)	NE. 22-22-3-5	36.0	39.05	1.26	49.00
Aug. 26	do	do do	do	42.0	45.90	1.69	78.00
Oct. 25	W. H. Hannan	do do	do	35.0	32.10	1.57	50.00
July 22	H. C. Ritchie	Grand Valley creek	SW. 24-26-5-5	14.0	5.80	0.91	5.30
Aug. 8	do	do	do	15.0	9.60	0.74	7.10
Sept. 22	do	do	do	15.0	12.20	2.17	26.00
July 22	do	Horse creek	NE. 8-26-4-5	15.0	13.10	0.90	11.80
Aug. 8	do	do	do	15.6	8.30	0.72	5.90
Sept. 28	do	do	do	18.0	10.40	1.34	13.90
Mar. 28	do	Overflow, Power House, Lake Louise	NE. 20-28-16-5	.....	.....	.....	0.86*x*
May 30	do	do	do	.....	.....	.....	8.60*x*
June 23	do	do	do	.....	.....	.....	12.40*x*
July 6	do	do	do	.....	.....	.....	13.60*x*
July 27	do	do	do	.....	.....	.....	12.40*x*
Aug. 15	do	do	do	2.50	3.70	2.92	10.90
Sept. 5	do	do	do	.....	.....	.....	14.00*x*
Oct. 2	do	do	do	.....	.....	.....	11.10*x*
Oct. 26	do	do	do	.....	.....	.....	2.10*x*
Nov. 17	do	do	do	.....	.....	.....	2.40*x*
July 22	do	Spencer creek	SE. 18-26-5-5	19.0	11.20	1.44	16.20
Aug. 8	do	do	do	19.5	10.00	1.32	13.20
Sept. 22	do	do	do	20.8	12.54	1.60	20.00

x Weir measurement.

LITTLE BOW RIVER DRAINAGE BASIN

General Description

The source of Little Bow river is a spring in the town of High River in Section 6, Township 19, Range 28, West of the 4th Meridian. From here it flows in a southeasterly direction for one hundred miles and empties into the Oldman river. In the first few miles the natural flow is dependent entirely on a number of small springs and coulees which are dry most of the year, but later is augmented by the flow from Mosquito creek, which drains the south and westerly part of the drainage basin.

There is a comparatively large flow in this stream during the spring freshets, but during summer it would under natural conditions dry up. There is a large number of ranchers and settlers on this stream and it is very important that there should be a good flow for domestic and stock watering purposes. For this reason, the Provincial Government has constructed a canal and diverts water from Highwood river into Little Bow river whenever required.

MOSQUITO CREEK NEAR NANTON

Location.—On the NE. ¼ Sec. 30, Tp. 16, Rge. 28, W. 4th Mer., about four miles from Nanton.

Records available.—August 1, 1908, to October 31, 1915. Discharge measurements only 1906-1908.

Gauge.—Vertical staff; elevation of zero maintained at 89.22 feet during 1908-1912, and at 89.47 feet during 1913-16.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—Liable to shift.

Discharge measurements.—Made with current-meter from the bridge at flood stages; by wading during low water.

Winter flow.—Station not maintained during the winter.

Observer.—Wm. Monkman.

Discharge Measurements of Mosquito creek near Nanton, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 31	J. M. Paul	25	18.9	2.63	3.07	50*g*
May 2	W. M. Edwards	27	20.6	2.30	2.67	47
May 23	do	27	18.2	1.86	2.55	34
June 20	do	49	50.8	2.29	3.05	116
July 22	do	40	50.1	1.18	2.90	59
Aug. 21	do	48	53.7	1.88	3.08	101
Sept. 19	do	50	48.2	1.50	2.83	72
Oct. 28	do	47	44.9	1.64	2.85	74

g Ice going out.

Daily Gauge Height and Discharge of Mosquito creek near Nanton, for 1916

Day	April		May		June		July	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.70	294	2.67	47	4.25	467	3.45	208
2	3.60	263	2.45	26	4.20	449	3.55	239
3	3.45	220	2.50	29	4.26	467	3.40	193
4	3.30	178	2.42	23	4.20	449	3.28	157
5	3.25	164	2.45	25	4.15	434	3.15	120
6	3.20	151	2.43	23	3.70	294	3.00	81
7	3.10	128	2.40	21	3.45	220	3.01	84
8	3.05	116	2.42	23	3.35	192	2.98	77
9	3.05	116	2.40	21	3.23	159	2.95	70
10	2.90	84	2.42	23	3.38	200	2.95	70
11	2.80	66	2.43	23	3.31	181	2.90	59
12	2.75	58	2.42	23	3.25	164	2.87	54
13	2.75	58	2.40	21	3.20	151	2.85	50
14	2.70	51	2.42	23	3.15	140	2.84	49
15	2.72	54	2.45	25	3.11	130	2.80	42
16	2.70	51	2.48	27	3.12	133	2.83	47
17	2.65	45	2.50	29	3.10	128	3.00	81
18	2.60	39	2.48	27	3.07	121	3.02	86
19	2.55	34	2.45	25	3.00	105	3.00	81
20	2.50	29	2.45	25	3.05	116	2.95	70
21	2.45	25	2.45	25	3.04	114	2.91	61
22	2.45	25	2.52	31	3.07	121	2.90	59
23	2.40	21	2.74	57	3.02	110	2.90	59
24	2.38	20	2.79	64	3.00	105	2.90	59
25	2.35	18	2.95	94	2.92	88	2.92	63
26	2.34	17	3.00	105	3.20	151	3.23	143
27	2.37	19	2.90	84	3.30	178	3.05	94
28	2.41	22	2.93	90	4.10	418	2.92	63
29	2.48	27	3.79	322	3.80	321	2.88	56
30	2.62	41	4.65	588	3.40	193	2.85	50
31	.....	.....	4.30	480	.....	.....	2.84	49

DAILY GAUGE HEIGHT AND DISCHARGE of Mosquito creek near Nanton, for 1916.—*Concluded.*

DAY	August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.83	47	2.65	24	2.93	90
2	2.83	47	2.66	25	2.94	92
3	2.82	45	4.10	420	2.93	90
4	2.83	47	5.40	849	2.93	90
5	2.84	49	4.70	604	3.05	116
6	2.83	47	4.64	585	3.08	123
7	2.80	42	3.65	278	3.10	128
8	2.79	41	3.05	116	3.07	121
9	.....	41*e*	2.98	101	3.00	105
10	.....	41*e*	2.94	92	2.94	92
11	.....	41*e*	2.89	82	2.90	84
12	2.80	42	2.90	84	2.88	80
13	2.78	39	2.94	92	2.86	77
14	2.74	34	2.90	84	2.78	63
15	2.70	29	2.90	84	2.75	58
16	2.66	25	2.87	79	2.72	54
17	.....	208*e*	2.87	79	2.86	77
18	.....	391*e*	2.87	79	2.90	84
19	4.57	575	2.83	71	2.93	90
20	3.44	205	2.81	68	3.00	105
21	3.24	146	2.80	66	3.05	116
22	3.15	120	2.80	66	3.00	105
23	3.03	88	2.82	70	2.97	99
24	2.92	63	2.80	66	2.96	97
25	2.85	50	2.80	66	2.94	92
26	2.77	38	2.80	66	2.92	88
27	2.71	30	2.78	63	2.91	86
28	2.68	27	2.79	64	2.85	75
29	2.66	25	2.81	68	2.83	71
30	2.65	24	2.85	75	2.80	66
31	2.65	24	.....	.....	2.79	64

e Discharge estimated.

MONTHLY DISCHARGE of Mosquito creek near Nanton, for 1916

(Drainage area 186 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-ft.
April	294	17	81	0.435	0.48	4,820
May	588	21	79	0.425	0.49	4,858
June	467	88	217	1.170	1.30	12,912
July	239	42	86	0.462	0.53	5,288
August	575	24	86	0.462	0.53	5,288
September	849	24	152	0.817	0.91	9,045
October	128	54	90	0.484	0.56	5,534
The period	.....	.....	.....	.....	4.80	47,745

MEAN MONTHLY DISCHARGE in Second-feet of Mosquito creek near Nanton

MONTH	1907-8	1908-9	1909-10	1910-11	1911-12	1912-13	1913-14	1914-15	1915-16	1916-17	Mean in Sec.-ft.	Mean in Acre-ft.
October		25.0	7.0	1.72	5.0	14.3	7.30	7.9	36	90	22	1,324
November					8.3[a]	14.8[c]						
December												
January												
February												
March								119.0[e]				
April			18.6	7.10		26.0[d]	44.00[b]	5.1	81		31	1,847
May		150.0	5.4	8.20		19.3	10.60	74.0	79		50	3,042
June		34.0	1.32	2.20	20.0[b]	31.0	2.90	257.0	217		78	4,639
July		41.0	0.01	2.80	31.0	36.0	0.50	228.0	86		53	3,272
August	44	9.4	nil	8.80	27.0	31.0	nil	105.0	86		35	2,126
September	26	5.9	1.76	6.30	21.0	7.0	nil	45.0	152		29	1,752
Total in Acre-feet	4,233	16,225	2,051	2,254	6,440	9,472	3,891	47,800	44,425			18,002

a 1-15.
b 4-30.
c 1-15.
d 20-30
e 15-31.

NANTON CREEK NEAR NANTON

Location.—On the SE. ¼ Sec. 19, Tp. 16, Rge. 28, W. 4th Mer., at highway bridge.
Records available.—August 3, 1908, to October 31, 1916.
Gauge.—Vertical staff. Zero of gauge maintained at 82.18 feet during 1908-11; zero of gauge maintained at 82.57 feet during 1912; zero of gauge maintained at 93.33 feet during 1913; zero of gauge maintained at 92.31 feet during 1914-16.
Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.
Channel.—Not liable to shift.
Discharge measurements.—Made with current-meter by wading above gauge.
Observer.—W. Monkman.

DISCHARGE MEASUREMENTS of Nanton creek near Nanton, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 31	J. M. Paul	9.0	6.60	0.86	2.95	5.7
May 2	W. M. Edwards	13.0	10.60	0.99	2.38	10.5
May 23	do	15.0	13.60	0.98	2.54	13.2
June 20	do	19.0	30.70	1.48	3.50	45.4
July 22	do	13.5	12.70	1.29	2.49	16.3
Aug. 21	do	16.0	23.90	1.14	2.80	27.0
Sept. 19	do	18.0	23.30	1.33	3.05	31.0
Oct. 28	do	17.0	20.00	1.15	2.86	23.0

DAILY GAUGE HEIGHT AND DISCHARGE of Nanton creek near Nanton, for 1916

DAY	May		June		July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.60	15.6	5.50	118	3.20	37.0	2.34	12.8	2.36	12.6	3.10	32.0
2	2.34	9.8	5.05	101	3.45	46.0	2.34	12.8	2.38	12.9	3.23	36.0
3	2.20	7.7	4.60	85	3.35	43.0	2.34	12.9	4.60	89.0	3.15	33.0
4	2.10	6.4	4.40	78	3.28	41.0	2.33	12.8	.....	87.0*e*	3.21	35.0
5	2.07	6.0	5.80	128	3.04	32.0	2.40	14.5	4.50	85.0	3.13	32.0
6	2.05	5.8	4.70	89	2.89	27.0	2.35	13.3	4.10	70.0	3.54	47.0
7	2.02	5.5	4.44	79	2.85	26.0	2.33	12.8	3.50	49.0	3.27	37.0
8	2.00	5.3	4.23	72	2.80	25.0	2.32	12.6	3.50	49.0	3.15	33.0
9	2.01	5.4	4.15	69	2.78	24.0	.....	12.6*e*	3.45	47.0	3.00	28.0
10	2.00	5.3	4.34	76	2.75	23.0	.....	12.9*e*	3.37	44.0	2.96	27.0
11	2.01	5.4	4.05	65	2.70	22.0	.....	13.2*e*	3.30	41.0	2.93	26.0
12	2.01	5.4	3.95	62	2.65	20.0	2.35	13.4	3.35	43.0	2.90	25.0
13	2.03	5.6	3.92	61	2.68	22.0	2.33	12.9	3.65	53.0	2.86	24.0
14	2.05	5.8	3.80	56	2.60	19.2	2.21	10.4	3.65	53.0	2.83	23.0
15	2.05	5.8	3.73	54	2.58	18.6	2.15	9.4	3.50	47.0	2.80	22.0
16	2.08	6.2	3.66	51	2.56	18.2	2.12	8.9	3.34	41.0	2.79	21.0
17	2.08	6.2	3.45	44	2.60	19.4	.....	100.0*e*	3.20	36.0	2.87	24.0
18	2.05	5.8	3.38	41	2.56	18.2	7.40*x*	192.0	3.09	33.0	3.00	28.0
19	2.02	5.5	3.35	40	2.54	17.8	4.67	93.0	3.05	31.0*s*	3.05	30.0
20	2.05	5.8	3.50	45	2.53	17.6	3.45	50.0	3.01	28.0	3.10	32.0
21	2.04	5.7	3.44	43*s*	2.50	16.6	3.20	41.0	3.00	28.0	3.35	40.0
22	2.55	14.4	3.37	41	2.49	16.3	3.01	34.0	3.00	28.0	3.20	35.0
23	3.10	32.0	3.25	37	2.47	16.0	2.90	30.0	3.00	28.0	3.09	31.0
24	3.34	40.0	3.19	35	2.44	15.2	2.70	23.0	2.99	28.0	3.00	28.0
25	3.15	33.0	3.18	35	2.46	15.8	2.59	19.7	2.98	27.0	2.95	26.0
26	3.25	37.0	3.40	43	3.25	10.8	2.40	14.4	2.98	27.0	2.93	26.0
27	3.15	33.0	3.55	49	2.75	25.0	2.35	12.7	2.95	26.0	2.91	25.0
28	4.15	69.0	4.85	96	2.60	20.0	2.35	12.7	2.91	25.0	2.75	20.0
29	5.05	101.0	3.65	53	2.44	15.3	2.35	12.6	2.86	24.0	2.50	13.1
30	6.30	146.0	3.38	43	2.40	14.2	2.36	12.9	2.91	25.0	2.70	18.5
31	4.90	96.0	.....	.....	2.38	13.8	2.36	12.5	.....	.....	2.63	16.4

e Discharge estimated.
x Maximum flood peak.
s - *s* Shifting conditions.

MONTHLY DISCHARGE of Nanton creek near Nanton, for 1916

(Drainage area 46 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
May	146	5.3	24	0.522	0.60	1,476
June	128	35.0	63	1.370	1.53	3,749
July	46	10.8	22	0.478	0.55	1,353
August	192	8.9	28	0.609	0.70	1,722
September	89	12.6	41	0.891	0.99	2,440
October	47	13.1	28	0.609	0.70	1.722
The period	.....	.....	.....	.....	5.07	12,462

MEAN MONTHLY DISCHARGE in Second-feet of Nanton creek near Nanton

MONTH	1907–8	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October		9.8	2.50	0.18	8.10	7.90	4.10	4.10	12.6	28.0	8.6	528
November					7.40*c*	8.80*g*						
December												
January												
February												
March								34.0*i*				
April			2.40	0.63	3.90*d*		12.90	2.5			4.6	275
May		40.0	2.10	2.70	3.20		3.10	18.5	24.0		13.4	824
June		19.9	0.19	2.70	4.40*e*		0.64	59.0	63.0		24.0	1,442
July		16.2		2.10			0.63	68.0	22.0		22.0	1,339
August	13.2*a*	3.9		9.60	8.90*f*		0.14	30.0	28.0		14.3	882
September	8.2	1.9	1.66*b*	5.90	12.80	3.20*h*	0.02	16.4	41.0		12.3	733
Total in Acre-feet	1,246	5,602	529	1,446	2,518	891	1,299	13,198	11,515			6,023

a 3-31.
b 5-30.
c 1-15.
d 13-30.
e 1-27.
f 6-31.
g 1-15.
h 8-30.
i 15-31.

OLDMAN RIVER DRAINAGE BASIN

General Description

The Oldman river is the largest of the two streams which, on their junction, form the South Saskatchewan river.

The main river is formed between the Rocky mountains and Livingstone range by the junction of Livingstone river, Northwest Branch, West Branch and Race Horse creek. It first flows southeasterly until joined by the Crowsnest and Castle rivers and then flows in a general easterly direction to its junction with the Bow river. There are a number of small tributaries joining the main stream and two large ones, the Belly river and the St. Mary river. These two streams empty into the river between Macleod and Lethbridge, and full descriptions of their basins are given elsewhere in this report.

The territory drained by this stream consists of mountains, foot-hills and prairie. The mountain region is quite extensive and is divided into the main range and the Livingstone range of the Rocky mountains. There is a good forest cover on many parts of the mountains and foot-hills, but much of the Livingstone range and some parts of the Rockies are precipitous and bare of tree growth. On the higher peaks considerable amount of snow collects and thus the streams are subject to high water caused by melting snows during the heat of the summer and in the early spring.

The precipitation throughout this basin varies greatly. It is heaviest in the mountains and decreases rapidly towards the eastern edge of the basin, where it is rather small. There are no irrigation projects of any size on the main river, although extensive surveys have been carried on with the object of irrigating a large area lying between the main river and the Little Bow river, water to be diverted west of Macleod. On the small tributaries a number of irrigation schemes are now in operation.

A special report upon the floods in this drainage basin was published in an Appendix to the 1915 report.

ALLISON CREEK NEAR SENTINEL

Location.—On the SW. ¼ Sec. 11, Tp. 8, Rge. 5, W. 5th Mer.
Records available.—Discharge measurements during 1914, 1915 and 1916.
Gauge.—Plain staff, graduated to hundredths; zero maintained at elevation 93.64 feet.
Bench-mark.—On stump of spruce tree, on left bank of creek; assumed elevation 100.00 feet.
Channel.—Not liable to shift.
Discharge measurements.—Made with current-meter by wading, twenty feet above gauge.
Winter flow.—Station not maintained during winter.
Observer.—None.

Discharge Measurements of Allison creek near Sentinel, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft*
Mar. 23	J. M. Paul	12.0	6.60	1.29	1.50	8.5
April 14	do	12.0	7.40	1.38	1.56	10.2
May 8	W. M. Edwards	13.0	10.10	2.50	1.80	25.0
June 6	do	14.0	12.80	3.49	2.00	45.0
July 4	do	15.5	21.20	4.17	2.50	88.0
Aug. 2	do	14.5	11.40	2.50	1.76	29.0
Aug. 30	do	14.0	8.40	2.20	1.70	18.4
Nov. 16	do	14.0	15.00	0.95	1.95	14.2

CROWSNEST RIVER NEAR COLEMAN

Location.—On SW. ¼ Sec. 12, Tp. 8, Rge. 5, W. 5th Mer., near Prudent Le Gal's house.

Records available.—June 13, 1910, to December 31, 1916.

Gauge.—Vertical staff. Zero maintained at elevation of 92.12 feet during 1910-12; zero maintained at elevation of 92.73 feet during 1913-16.

Bench-mark.—Permanent iron bench-mark, located on left bank at the station; assumed elevation 100.00 feet.

Channel.—Composed of gravel and slightly shifting.

Discharge measurements.—Made from a wooden bridge during ordinary and high water, and by wading during low stages at a point about one mile below the gauge.

Winter flow.—Discharge measurements continued during the winter season.

Observer.—Prudent Le Gal.

Remarks.—All measurements were made from wooden bridge during open water in 1916.

Discharge Measurements of Crowsnest river near Coleman, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft*
Jan. 11	W. R. McCaffrey	24.0	29.6	1.01	2.10	30
Jan. 26	H. W. Rowley	21.0	26.4	1.10	1.94	29
Feb. 9	do	22.0	30.6	0.96	1.93	29
Feb. 24	do	22.0	33.8	1.15	1.48	39
Mar. 13	do	24.0	35.2	1.34	1.60	47
Mar. 23	J. M. Paul	25 0	33.8	1.31	1.60	44
April 14	do	26.0	39.9	1.83	1.84	73
May 8	W. M. Edwards	31.0	67.9	3.63	2.97	247
June 6	do	31.0	66.4	4.16	3.14	276
June 27	do	31.0	104.0	5.01	4.40	521
July 4	do	32.0	102.2	4.82	4.35	492
Aug. 2	do	28.0	57.8	3.32	2.90	192
Aug. 30	do	28.0	50.0	2.46	2.44	123
Oct. 16	E. J. Switzer	23.7	32.8	1.63	1.87	54
Oct. 16	do	28.5	37.6	1.55	1.87	59
Nov. 16	W. M. Edwards	24.0	25.2	1.08	2.06	26
Dec. 7	do	23.0	29.3	0.93	2.05	27
Dec. 22	E. J. Switzer	25.0	31.5	1.03	1.79	33

DAILY GAUGE HEIGHT AND DISCHARGE of Crowsnest river near Coleman, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.78	38	1.49	26	1.83	40	1.60	47	2.14	114	2.54	175
2	1.81	37	1.40	25	1.93	42	1.61	48	2.15	115	2.59	183
3	2.73	37	1.53	26	2.13	45	1.61	48	2.25	129	2.49	167
4	1.90	36	1.49	26	1.97	46	1.58	45	2.50	169	2.79	215
5	1.94	36	1.52	26	1.70	43	1.65	52	2.70	201	3.09	268
6	1.93	35	1.39	25	1.78	43	1.64	51	2.80	217	3.09	268
7	1.78	34	1.51	25	1.63	41	1.65	52	3.00	252	3.20	288
8	1.76	33	1.74	27	1.95	43	1.65	52	2.99	250	3.20	288
9	1.53	32	1.75	29	2.79	49	1.75	62	2.94	241	3.71	381
10	1.73	31	1.80	38	1.65	52	1.79	67	2.74	207	3.66	371
11	1.98	30	2.04	56	1.69	56	1.81	69	2.55	177	3.56	353
12	1.83	28	1.85	56	1.69	56	1.83	72	2.52	172	3.47	337
13	1.67	27	2.09	90	1.60	47	1.85	74	2.44	159	3.59	358
14	1.58	27	2.72	196	1.56	44	1.87	76	2.39	151	3.73	385
15	1.45	26	2.95	212	1.56	44	1.93	84	2.29	135	3.99	437
16	1.46	26	2.68	198	1.54	42	1.92	83	.....	134*e*	4.69	585
17	1.46	27	2.02	97	1.55	43	1.92	83	2.27	132	4.70	587
18	1.49	28	1.69	56	1.55	43	1.88	78	2.30	137	5.05	664
19	1.49	28	1.60	47	1.60	47	1.89	79	2.33	142	5.29	717
20	1.62	29	1.56	44	1.66	53	1.88	78	2.45	161	5.06	666
21	1.80	30	1.55	43	1.65	52	1.88	78	2.53	174	5.32	723
22	1.86	32	1.52	41	1.60	47	1.86	75	2.59	183	4.99	651
23	1.92	33	1.55	43	1.60	47	1.84	73	2.61	187	4.58	561
24	1.91	33	1.48	37	1.63	50	1.84	73	2.54	175	4.48	539
25	2.10	34	1.46	36	1.62	49	1.89	79	2.46	163	4.49	541
26	1.85	29	1.41	32	1.63	50	1.93	84	2.45	161	4.49	541
27	1.50	28	1.44	34	1.65	52	2.00	94	2.42	156	4.41	523
28	1.70	27	1.44	34	1.60	47	2.14	114	2.42	156	4.60	552
29	2.05	29	1.49	38	1.60	47	2.15	115	2.54	159	4.55	540
30	1.75	31	.....	.....	1.59	46	2.15	115	2.59	183	4.36	494
31	1.55	28	.....	.....	1.60	47	.....	.....	2.57	180	.....	.....

e Discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of Crowsnest river near Coleman, for 1916.—*Concluded.*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1....	4.10	432	2.87	188	2.40	118	1.97	66	1.90	59	1.82	25
2....	4.60	552	2.85	185	2.40	118	1.98	67	1.89	58	1.75	26
3....	4.56	542	2.80	177	2.44	124	1.98	67	1.88	57	1.73	26
4....	4.22	461	2.75	169	2.65	153	1.98	67	1.88	57	1.75	26
5....	4.02	414	2.73	166	2.80	177	1.97	66	1.86	55	1.75	27
6....	4.04	419	2.70	161	2.65	153	1.95	64	1.84	53	1.75	27
7....	3.99	408	2.66	155	2.61	147	1.97	66	1.86	51	2.12	27
8....	4.07	425	2.62	149	2.48	129	1.86	55	1.88	48	2.70	28
9....	4.04	419	2.86	187	2.45	125	1.84	53	1.88	46	1.72	28
10....	4.00	410	2.85	185	2.42	121	1.82	52	1.86	44	1.70	28
11....	3.97	403	2.79	175	2.45	125	1.83	52	1.83	43	2.65	30
12....	3.84	375	2.82	180	2.36	112	1.84	53	2.32	41	1.77	30
13....	3.82	370	2.70	161	2.30	104	1.86	55	2.31	32	1.93	30
14....	3.71	346	2.67	156	2.28	102	1.86	55	2.25	28	1.93	29
15....	3.48	298	2.67	156	2.26	99	1.86	55	1.58	27	1.93	30
16....	3.53	308	2.62	149	2.23	96	1.84	53	2.12	26	1.91	33
17....	3.63	329	2.58	143	2.21	93	1.82	52	2.00	26	1.89	34
18....	3.52	306	2.60	146	2.20	92	1.80	50	1.96	25	1.87	31
19....	3.49	300	2.54	138	2.00	69	1.80	50	1.94	24	1.88	33
20....	3.28	258	2.51	133	1.98	67	1.80	50	1.86	24	1.86	35
21....	3.28	258	2.55	139	2.52	135	1.80	50	1.81	25	1.86	34
22....	3.35	272	2.52	135	2.23	96	1.80	50	1.79	25	1.88	33
23....	3.23	249	2.50	132	2.00	69	1.82	52	1.75	24	1.91	33
24....	3.02	212	2.50	132	1.97	66	1.84	53	1.96	25	1.92	33
25....	3.02	212	2.46	126	2.00	69	1.86	55	1.91	26	1.92	34
26....	3.02	212	2.44	124	2.00	69	1.90	59	1.78	25	1.92	34
27....	3.02	212	2.44	124	2.00	69	1.90	59	1.77	24	1.93	34
28....	2.97	204	2.40	118	1.98	67	1.90	59	1.77	24	2.37	35
29....	2.93	198	2.44	124	1.96	65	1.90	59	1.78	24	2.63	37
30....	2.95	201	2.44	124	1.97	66	1.90	59	1.78	25	2.59	38
31....	2.92	196	2.44	124	.....	.....	1.90	59	.....	.....	2.58	38

MONTHLY DISCHARGE of Crowsnest river near Coleman, for 1916

(Drainage area 70 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	38	26	31	0.443	0.51	1,906
February	212	25	57	0.814	0.88	3,279
March	56	40	47	0.671	0.77	2,890
April	115	45	73	1.040	1.16	4,344
May	252	114	170	2.430	2.80	10,453
June	723	167	445	6.360	7.10	26,479
July	552	196	329	4.700	5.42	20,229
August	188	118	150	2.140	2.47	9,223
September	177	65	103	1.470	1.64	6,129
October	67	50	57	0.814	0.94	3,505
November	59	24	36	0.514	0.57	2,142
December	38	25	31	0.443	0.51	1,906
The year	.....	.....	.....	.....	24.77	92,485

MEAN MONTHLY DISCHARGE in Second-feet of Crowsnest river near Coleman

MONTH	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec-ft.	Mean in Acre-ft.
October	.....	118	69	57	88	129	70	57	84	5,432
November	.....	84*b*	88	62	71	98	63	36	70	4,154
December	.....	.....	34	41	60	59	46	31	45	2,771
January	.....	.....	37	28	42	44	31	.....	36	2,238
February	.....	.....	32	24	33	33	57	.....	36	2,021
March	.....	41	30	25	44	38	47	.....	38	2,258
April	.....	62	47	65	102	76	73	.....	71	4,221
May	.....	253	128	158	284	239	170	.....	205	12,626
June	.....	477	186	329	261	256	445	.....	326	19,378
July	128*a*	232	190	191	202	214	329	.....	226	13,916
August	96	143	98	150	109	126	150	.....	125	7,661
September	92	154	71	95	88	71	103	.....	96	5,731
Total in Acre-feet	12,410	89,030	61,222	74,140	83,855	85,645	95,813	.....	.....	82,407

a 28-31.
b 1-5.

MCGILLIVRAY CREEK NEAR COLEMAN

Location.—On SE. ¼ of Sec. 7, Tp. 8, Rge. 4, W. 4th Mer., about 150 feet north of the Canadian Pacific Railway Company's culvert across the creek.

Records available.—January 9, 1913, to June 15, 1915, and discharge measurements only in 1916.

Gauge.—Vertical staff; zero elevation 97.01 feet.

Bench-mark.—Stump on left bank about fifty feet down stream from the gauge; assumed elevation 100.00 feet.

Channel.—Gravel and slightly shifting.

Discharge measurements.—Made with a current-meter by wading during low stages and from a foot-bridge, during high water.

Winter flow.—Discharge measurements only made during the winter season.

Observer.—None engaged during 1916.

DISCHARGE MEASUREMENTS of McGillivray creek near Coleman, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 26	H. W. Rowley	9.0	4.90	0.45	1.12	2.20
Feb. 24	do	12.0	6.00	0.50	1.11	3.00
Mar. 13	do	14.0	7.90	0.72	1.18	5.70
Mar. 23	J. M. Paul	14.0	7.40	0.72	1.24	5.30
April 14	do	18.0	10.60	1.50	1.46	15.90
May 8	W. M. Edwards	23.0	26.20	2.59	2.12	68.00
June 6	do	24.0	25.30	2.19	2.12	55.00
July 4	do	21.0	25.30	2.76	2.20	70.00
Aug. 2	do	19.0	9.75	1.02	1.46	9.90
Aug. 30	do	18.0	6.80	0.84	1.35	5.70
Oct. 16	E. J. Switzer	10.8	8.73	0.37	1.32	3.20
Nov. 16	W. M. Edwards	8.0	6.15	0.50	1.30	3.10
Dec. 7	do	9.5	6.88	0.29	.....	2.00
Dec. 22	do	10.0	6.20	0.18	.....	1.11

CROWSNEST RIVER NEAR FRANK

Location.—On the NE. ¼ Sec. 36, Tp. 7, Rge. 4, W. 5th Mer., at the traffic bridge.

Records available.—June 13, 1910, to December 31, 1916.

Gauge.—Vertical staff. Altered to box chain gauge, August 1, 1916, located on the traffic bridge; zero elevation 90.57.

Bench-mark.—A stump on the left bank about twenty-four feet from the new chain gauge; assumed elevation of bench-mark 100.00 feet.

Channel.—Gravel and fairly permanent.

Discharge measurements.—Made from traffic bridge during high water and by wading in low stages.

Winter flow.—Discharge measurements are continued during the winter season.

Observer.—I. Wilson.

DISCHARGE MEASUREMENTS of Crowsnest river near Frank, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 12	W. R. McCaffrey	50.0	45.0	1.42	4.12	64
Jan. 27	H. W. Rowley	48.0	36.4	1.30	4.06	48
Feb. 8	do	46.0	31.6	1.30	3.97	41
Feb. 25	do	51.0	49.6	1.61	4.28	80
Mar. 14	do	55.0	59.0	1.85	4.46	109
Mar. 24	J. M. Paul	55.0	64.5	1.95	4.54	126
April 15	do	70.0	122.0	3.23	5.25	394
May 9	W. M. Edwards	73.0	147.4	3.92	5.76	578
June 5	do	73.0	165.4	4.24	6.10	701
June 27	do	73.0	179.0	4.84	6.28	867
July 4	do	73.0	190.9	5.05	6.43	964
Aug. 1	do	68.0	92.6	2.68	5.17	248
Aug. 29	do	68.0	60.2	2.24	4.81	135
Oct. 17	E. J. Switzer	67.4	56.0	1.42	4.54	80
Nov. 17	W. M. Edwards	54.0	41.3	1.30	4.32	54
Dec. 6	do	55.0	43.5	1.25	4.36	54
Dec. 21	E. J. Switzer	52.0	38.2	1.21	4.28	46

DAILY GAUGE HEIGHT AND DISCHARGE of Crowsnest river near Frank, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.05	50	4.02	47	4.15	62	4.45	138	5.30	374	5.40	351
2	4.05	50	4.00	45	4.15	62	4.45	139	5.65	544	5.40	348
3	4.06	51	4.00	45	4.15	62	4.45	140	6.30	908	5.55	413
4	4.06	51	3.98	43	4.15	62	4.45	141	6.50	1,030	5.65	460
5	4.07	52	3.98	43	4.15	62	4.45	142	6.35	929	6.00	646
6	4.09	55	3.97	42	4.15	62	4.55	167	6.65	1,112	5.95	621
7	4.10	56	3.97	42	4.14	61	4.67	198	6.40	954	5.95	623
8	4.12	58	3.93	38	4.15	62	4.85	250	6.10	768	6.05	681
9	4.12	58	3.97	42	4.18	66	4.90	265	5.80	598	6.15	739
10	4.12	58	3.97	42	4.35	91	5.05	319	5.50	439	6.20	771
11	4.10	56	3.97	42	4.55	129	5.00	300	5.40	391	6.10	715
12	4.10	56	3.97	42	4.62	144	4.97	288	5.30	345	6.05	689
13	4.10	56	3.98	43	4.55	129	5.00	297	5.26	328	6.10	722
14	4.10	56	4.00	45	4.51	121	5.40	469	5.25	321	6.20	783
15	4.10	56	4.04	49	4.45	109	5.25	394	5.25	320	6.50	967
16	4.10	56	4.45	109	4.40	100	5.00	292	5.25	319	6.90	1,216
17	4.10	56	4.40	100	4.38	96	4.97	279	5.25	317	7.20	1,403
18	4.09	55	4.40	100	4.42	104	4.95	270	5.40	377	7.35	1,503
19	4.09	55	4.35	91	4.43	105	4.93	263	5.47	404	7.50	1,594
20	4.08	54	4.30	83	4.52	123	4.90	251	5.55	442	7.63	1,684
21	4.08	54	4.28	80	4.60	140	4.90	250	5.50	418	7.31	1,487
22	4.07	52	4.28	80	4.56	131	4.90	249	5.45	390	6.83	1,194
23	4.20	69	4.28	80	4.54	127	4.90	247	5.40	370	6.42	941
24	.....	60*e*	4.26	77	4.52	123	4.90	244	5.35	345	6.38	920
25	4.05	50	4.25	76	4.50	125	5.20	349	5.28	314	6.33	892
26	4.05	50	4.25	76	4.45	119	5.65	568	5.30	321	6.33	888
27	4.04	49	4.24	75	4.45	123	5.85	670	5.35	341	6.28	859
28	4.04	49	4.20	69	4.45	127	5.60	532	5.60	450	6.55	1,036
29	4.04	49	4.16	63	4.44	128	5.40	425	5.55	424	6.60	1,067
30	4.04	49	.....	.....	4.43	128	5.35	399	5.53	410	6.35	912
31	4.02	47	.....	.....	4.42	128	.....	.....	5.45	376	.....	.....

e Discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of Crowsnest river near Frank, for 1916—*Concluded*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	6.40	943	5.07	212	4.80	132	4.61	93	4.47	70	4.37	56
2	6.53	1,024	5.06	208	4.80	132	4.60	91	4.47	70	4.37	56
3	6.60	1,067	5.05	205	4.95	172	4.60	91	4.48	71	4.37	56
4	6.33	900	5.05	205	5.00	188	4.60	91	4.48	71	4.37	56
5	6.15	788	5.03	198	4.98	182	4.60	91	4.48	71	4.37	56
6	6.05	726	5.02	195	4.94	169	4.60	91	4.47	70	4.36	55
7	6.00	696	5.00	188	4.88	153	4.60	91	4.45	67	4.35	54
8	6.00	696	5.00	188	4.84	142	4.59	89	4.43	64	4.30	48
9	5.95	666	5.20	260	4.83	140	4.58	87	4.45	67	4.28	46
10	5.90	636	5.13	233	4.80	132	4.57	86	4.43	64	4.28	46
11	5.85	606	5.08	215	4.78	127	4.57	86	4.43	64	4.26	44
12	5.78	564	5.08	215	4.75	120	4.56	84	4.33	52	4.25	43
13	5.73	534	5.05	205	4.74	118	4.56	84	4.28	46	4.25	43
14	5.68	504	5.03	198	4.74	118	4.56	84	4.23	41	4.25	43
15	5.60	458	5.00	188	4.73	116	4.56	84	4.26	44	4.25	43
16	5.60	458	4.97	178	4.72	113	4.56	84	4.28	46	4.25	43
17	5.60	458	4.95	172	4.71	111	4.51	76	4.40	60	4.28	46
18	5.58	447	5.00	188	4.70	109	4.51	76	4.35	54	4.28	46
19	5.50	403	4.95	172	4.68	105	4.50	74	4.35	54	4.30	48
20	5.43	367	4.93	166	4.68	105	4.49	73	4.35	54	4.30	48
21	5.40	352	4.90	158	4.67	104	4.48	71	4.35	54	4.30	48
22	5.38	342	4.88	153	4.65	100	4.48	71	4.35	54	4.30	48
23	5.33	317	4.85	145	4.65	100	4.48	71	4.35	54	4.30	48
24	5.30	303	4.85	145	4.65	100	4.47	70	4.35	54	4.28	46
25	5.27	289	4.85	145	4.64	98	4.47	70	4.35	54	4.28	46
26	5.23	272	4.85	145	4.64	98	4.47	70	4.35	54	4.26	44
27	5.30	303	4.85	145	4.63	96	4.50	74	4.36	55	4.26	44
28	5.29	298	4.83	140	4.62	95	4.48	71	4.37	56	4.26	44
29	5.28	294	4.82	137	4.62	95	4.48	71	4.37	56	4.25	43
30	5.23	272	4.82	137	4.61	93	4.47	70	4.37	56	4.25	43
31	5.17	248	4.81	135	.....	.....	4.47	70	.....	.....	4.26	44

MONTHLY DISCHARGE of Crowsnest iver rnear Frank, for 1916

(Drainage area 168 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	69	47	54	0.321	0.37	3,320
February	109	38	62	0.369	0.40	3,566
March	144	61	104	0.619	0.71	6,395
April	670	138	298	1.770	1.98	17,732
May	1,112	314	496	2.950	3.41	30,498
June	1,684	348	904	5.380	6.00	53,792
July	1,067	248	524	3.120	3.60	32,220
August	260	135	180	1.070	1.23	11,068
September	188	93	122	0.726	0.81	7,260
October	93	70	80	0.476	0.55	4,919
November	71	41	58	0.345	0.38	3,451
December	56	43	48	0.286	0.33	2,951
The year	.....	.....	.....	.....	19.77	177,172

MEAN MONTHLY DISCHARGE in Second-feet of Crowsnest river near Frank

MONTH	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	210	136	75	110	219	104	80	133	8 203
November	.....	.....	68	76	85	170	82	58	90	5,346
December	.....	.....	63	54	51	98	54	48	61	3,776
January	.....	50	46	52	64	67	54	.....	56	3,422
February	.....	46	41	41	49	53	62	.....	42	2,740
March	.....	58	37	36	52	52	104	.....	56	3,474
April	.....	224	194	253	238	235	298	.....	240	14,304
May	.....	642	392	469	484	559	496	.....	507	31,177
June	.....	855	370	577	392	450	904	.....	591	35,190
July	134 *a*	297	360	261	236	332	524	.....	335	20,598
August	109	220	157	178	140	173	180	.....	165	10,160
September	112	306	96	120	124	95	122	.....	139	8,286
Total in acre-feet	14,163	175,833	118,939	132,489	122,620	151,704	180,445	.....	.....	146,676

a 29-31

CROWSNEST RIVER NEAR LUNDBRECK

Location.—On the NE. ¼ Sec. 26, Tp. 7, Rge. 2, W. 5th Mer., at the traffic bridge just north of Lundbreck.

Records available.—September 7, 1907, to December 31, 1916.

Gauge.—Chain, on downstream side of the traffic bridge. Elevation at zero of staff gauge maintained at 91.82 feet during 1912-13. Elevation at zero of chain gauge maintained at 90.86 feet during 1914-15-16.

Bench-mark.—Permanent bench-mark cut in the left wing-wall on the downstream side; assumed elevation 100.00 feet.

Channel.—Rocky formation and fairly permanent.

Discharge measurements.—Made from the traffic bridge.

Winter flow.—Records are obtained throughout the frozen period.

Observer.—Ed. Marlow.

DISCHARGE MEASUREMENTS of Crowsnest river near Lundbreck, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 13	W. R. McCaffrey	52.0	43.6	1.34	3.12	59
Jan. 29	H. W. Rowley	41.0	46.8	1.62	3.26	76
Feb. 14	do	40.0	44.8	1.64	3.15	73
Feb. 19	J. E. Caughey	.....	.....	.....	3.95	269*x*
Feb. 26	H. W. Rowley	87.0	77.3	1.74	3.25	134
Mar. 21	J. M. Paul	60.0	114.0	2.43	2.42	277
April 11	do	66.0	143.0	3.20	2.92	457
May 11	W. M. Edwards	68.0	170.7	3.94	3.28	673
June 7	do	69.0	198.2	4.79	3.70	949
June 22	W. H. Hannan	76.0	304.2	5.78	5.06	1,758
June 23	do	72.0	236.6	5.79	4.35	1,370
June 24	do	71.0	198.3	5.27	3.95	1,045
June 26	do	72.0	207.5	5.43	4.05	1,126
June 29	do	72.0	230.0	5.86	4.35	1,346
June 30	do	72.0	226.9	5.68	4.12	1,288
July 6	W. M. Edwards	69.0	197.2	4.88	3.80	963
Aug. 9	do	63.0	120.8	3.12	2.67	376
Sept. 7	do	59.0	102.2	2.31	2.31	236
Oct 18	E. J. Switzer	55.6	79.9	1.84	1.91	147
Nov. 21	W. M. Edwards	63.0	96.1	1.02	2.96	98
Dec. 8	do	69.0	56.8	0.80	2.16	46
Dec. 27	E. J. Switzer	65.0	84.3	0.77	3.00	65

x Water running over and under ice.

DAILY GAUGE HEIGHT AND DISCHARGE of Crowsnest river near Lundbreck, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1....	2.42	52	3.27	77	4.66	295	2.20	209	3.18	620	3.30	681
2....	2.67	52	3.17	78	4.86	288	2.21	212	3.27	665	3.25	655
3....	2.77	52	3.19	78	4.66	282	2.24	219	3.42	746	3.20	630
4....	2.82	52	3.17	76	4.89	283	2.22	214	3.92	1,040	3.40	735
5....	2.82	52	3.17	74	4.34	276	2.19	207	3.99	1,086	3.85	995
6....	2.82	52	3.19	72	4.61	272	2.24	219	3.91	1,034	3.75	934
7....	2.85	53	3.21	72	4.16	266	2.39	266	4.21	1,241	3.60	846
8....	2.87	54	3.22	71	4.39	267	2.54	320	3.90	1,027	3.65	875
9....	2.97	54	3.27	72	4.40	261	2.64	364	3.40	735	3.95	1,060
10....	2.97	56	3.32	72	2.34	249	2.74	408	3.28	671	3.97	1,073
11....	2.92	57	3.32	72	2.56	328	2.79	430	3.28	671	3.95	1,060
12....	2.92	59	3.17	70	2.59	342	2.74	408	3.10	580	3.70	904
13....	3.13	59	3.07	71	2.34	249	2.79	430	3.10	580	3.75	934
14....	3.13	59	3.47	73	2.29	234	2.88	472	3.10	580	3.75	934
15....	3.07	58	5.14	180	2.24	219	2.98	520	3.06	560	3.98	1,080
16....	3.07	58	5.39	293	2.19	207	2.83	449	3.04	550	4.20	1,234
17....	3.07	59	4.34	280	2.14	195	2.82	444	3.00	530	4.30	1,308
18....	3.02	62	4.09	273	2.14	195	2.72	399	3.05	555	4.40	1,382
19....	3.07	66	3.94	269	2.19	207	2.67	377	3.20	630	4.58	1,515
20....	3.07	69	3.59	254	2.39	266	2.71	394	3.35	708	4.70	1,604
21....	2.97	68	3.54	234	2.44	283	2.66	372	3.40	735	4.95	1,789
22....	2.97	66	3.39	214	2.34	249	2.61	350	3.18	620	5.06	1,870
23....	2.87	64	3.29	194	2.29	234	2.59	342	3.12	590	4.35	1,345
24....	2.77	64	3.34	171	2.29	234	2.60	346	3.08	570	3.95	1,060
25....	2.87	67	3.44	153	2.29	234	2.65	368	3.10	580	3.95	1,060
26....	2.97	70	3.24	134	2.26	225	2.94	500	3.04	550	4.05	1,127
27....	3.22	73	3.29	135	2.24	219	3.34	703	3.05	555	3.94	1,053
28....	3.22	75	3.29	137	2.19	207	3.74	928	3.45	762	4.25	1,271
29....	3.27	76	5.44	214	2.19	207	3.33	697	3.45	762	4.35	1,345
30....	3.29	76	.....	.....	2.14	195	3.03	545	3.45	762	4.05	1,127
31....	3.29	77	.....	.....	2.19	207	.....	.....	3.45	762	.....	.....

DAILY GAUGE HEIGHT AND DISCHARGE of Crowsnest river near Lundbreck, for 1916.—*Concluded.*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.90	1,027	2.55	324	2.20	209	1.96	156	1.86	137	2.80	71
2	4.30	1,308	2.50	304	2.18	204	1.95	154	1.85	135	2.50	74
3	4.18	1,220	2.50	304	2.20	209	1.95	154	1.84	133	2.50	75
4	4.05	1,127	2.48	297	2.33	246	1.95	154	1.86	137	2.45	73
5	3.95	1,060	2.48	297	2.35	252	1.95	154	1.88	140	2.50	68
6	3.80	964	2.45	286	2.35	252	1.95	154	1.88	140	2.55	57
7	3.65	875	2.38	262	2.31	240	1.95	154	1.87	139	2.25	50
8	3.60	846	2.38	262	2.28	231	1.90	144	1.89	142	2.30	46
9	3.50	790	2.67	377	2.23	217	1.90	144	1.90	144	2.30	45
10	3.48	779	2.65	368	2.19	207	1.90	144	1.80	126	2.35	45
11	3.45	762	2.58	337	2.15	197	1.90	144	1.75	117	2.40	47
12	3.40	735	2.50	304	2.12	190	1.90	144	2.70	98	2.55	48
13	3.30	681	2.48	297	2.15	197	1.88	140	2.87	97	2.58	47
14	3.20	630	2.46	290	2.10	185	1.90	144	2.85	103	2.58	45
15	3.15	605	2.40	269	2.10	185	1.90	144	2.30	100	2.56	44
16	3.10	580	2.40	269	2.11	187	1.88	140	2.22	98	2.57	44
17	3.10	580	2.44	283	2.09	183	1.90	144	3.23	100	2.55	48
18	3.05	555	2.48	297	2.08	181	1.90	144	3.16	102	2.70	46
19	3.00	530	2.40	269	2.06	176	1.88	140	3.00	100	2.75	49
20	2.98	520	2.38	262	2.05	174	1.90	144	3.10	99	2.90	58
21	2.88	472	2.30	237	2.02	168	1.90	144	2.90	98	2.70	55
22	2.85	458	2.30	237	2.00	164	1.90	144	2.80	96	2.85	58
23	2.80	435	2.28	231	2.00	164	1.88	140	2.75	93	2.98	60
24	2.75	412	2.26	225	2.01	166	1.88	140	2.60	90	2.96	60
25	2.75	412	2.24	219	2.02	168	1.86	137	2.65	86	2.98	62
26	2.70	390	2.25	222	2.00	164	1.88	140	2.60	81	2.95	64
27	2.70	390	2.23	217	1.98	160	1.95	154	2.57	77	2.98	65
28	2.70	390	2.22	214	1.96	156	1.93	150	2.57	73	3.10	68
29	2.65	368	2.20	209	1.95	154	1.90	144	2.65	70	3.20	70
30	2.60	346	2.18	204	1.95	154	1.88	140	2.70	70	3.25	72
31	2.58	337	2.20	209	.....	.....	1.87	139	.....	.....	3.26	72

MONTHLY DISCHARGE of Crowsnest river near Lundbreck, for 1916

(Drainage area 276 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	77	52	62	0.225	0.26	3,812
February	293	70	144	0.522	0.56	8,283
March	342	195	248	0.898	1.04	15,249
April	928	207	404	1.460	1.63	24,040
May	1,241	530	712	2.580	2.97	43,779
June	1,870	630	1,116	4.040	4.51	66,407
July	1,308	337	664	2.410	2.78	40,828
August	377	204	270	0.978	1.13	16,602
September	252	154	191	0.692	0.77	11,365
October	156	137	146	0.529	0.61	8,977
November	144	70	107	0.388	0.43	6,367
December	75	44	58	0.210	0.24	3,566
The year	.....	.....	.....	.....	16.93	249,275

MEAN MONTHLY DISCHARGE in Second-feet of Crowsnest river near Lundbreck

MONTH	1907–8	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	149	143	219	257	132	148	310	160	146	185	11,371
November	.....	.....	175	188c	175	145	120	225	136	107	155	9,207
December	.....	.....	.....	.....	79	105	103	123	92	58	93	5,738
January	.....	.....	.....	85	98	78	84	131	62	.....	90	5,508
February	.....	.....	.....	91	86	69	72	79	144	.....	90	5,080
March	.....	.....	.....	111	97	77	91	95	248	.....	103	7,365
April	.....	235b	445	352	324	411	333	307	404	.....	368	21,894
May	.....	847	583	976	530	706	589	861	712	.....	726	44,606
June	.....	1,425	450	996	488	717	438	600	1,116	.....	779	46,339
July	.....	785	245	736	487	330	271	458	664	.....	497	30,568
August	.....	439	138	345	239	240	177	251	270	.....	262	16,124
September	152a	187	134	559	151	164	169	161	191	.....	214	12,766
Total in Acre-feet	4,522	239,899	139,814	280,226	182,507	191,849	159,028	218,380	253,953	.....	.....	216,566

a 16-30.
b 15-30.
c 1-26.

CONNELLY CREEK NEAR LUNDBRECK

Location.—On SE. ¼ Sec. 36, Tp. 7, Rge. 2, W. 5th Mer.

Records.—Discharge measurements only are available from August 20, 1908, to December 31, 1916. Gauge height records are available from August 1 to October 31, 1909; since then there has been no observer at this station.

Gauge.—Vertical staff, nailed to a tree on the left bank; zero elevation of gauge 96.07 feet.

Bench-mark.—On the head of a bolt driven vertically in a notch cut in a leaning tree, on the left bank; assumed elevation 100.00 feet.

Discharge measurements.—Made with current-meter by wading in high water and by means of an 18-inch weir in low stages.

Winter flow.—Discharge measurements are not made during the winter season.

DISCHARGE MEASUREMENTS of Connelly creek near Lundbreck, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 21	J. M. Paul	12.0	10.0	2.00	2.82	20.00
April 11	do	11.5	8.2	1.58	2.60	13.00
May 16	W. M. Edwards	12.0	7.7	1.50	2.58	11.50
June 7	do	12.0	9.1	2.12	2.73	19.20
June 26	W. H. Hannan	11.5	7.3	1.72	2.65	12.50
July 6	W. M. Edwards	11.5	8.6	1.92	2.68	16.50
Aug. 9	do	10.5	5.4	1.27	2.46	7.00
Sept. 7	do	10.0	5.1	0.52	2.28	2.70
Nov. 21	do	7.0	2.8	0.64	2.51	1.75

COW CREEK NEAR COWLEY

Location.—On NE. ¼ Sec. 14, Tp. 8, Rge. 2, W. 5th Mer., at John Ross ranch, five miles north of Lundbreck.

Records available.—August 20, 1908, to October 31, 1915.

Gauge.—Vertical enamel staff, graduated to hundredths; zero elevation maintained at 94.53 feet during 1912-16.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—Clay and rocks, fairly permanent.

Discharge measurements.—Made with current-meter from a foot bridge during high water and by wading in low stages.

Winter flow.—Discharge measurements are not made during the winter season.

Observer.—Thos. Ford.

Discharge Measurements of Cow creek near Cowley, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 21	J. M. Paul	8.0	11.60	2.41	2.87	28.0
April 11	do	8.5	12.50	1.51	2.48	18.9
May 11	W. M. Edwards	8.5	11.50	1.30	2.37	14.9
June 7	do	9.0	14.20	1.87	2.72	26.0
June 26	W. H. Hannan	9.0	13.90	1.52	2.62	25.0
July 6	W. M. Edwards	9.0	15.20	1.91	2.68	29.0
Aug. 9	do	8.5	11.40	1.31	2.35	15.0
Sept. 7	do	9.0	7.93	0.68	1.85	5.4
Nov. 21	do	9.0	6.50	0.85	1.98	5.5

Daily Gauge Height and Discharge of Cow creek near Cowley, for 1916

Day	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	2.40	15.0*e*	2.50	19.6	3.05	40.0
2	.....	.....	2.55	20.0*e*	2.50	19.6	2.80	30.0
3	.....	.....	2.30	13.0*e*	2.40	16.4	2.75	28.0
4	.....	.....	2.30	13.0*e*	2.40	16.4	2.65	25.0
5	.....	.....	2.35*g*	13.0*e*	2.30	13.6	2.65	25.0
6	.....	.....	2.20	11.0	2.50	19.6	2.60	23.0
7	.....	.....	2.30	13.6	2.60	23.0	2.70	26.0
8	.....	.....	2.30	13.6	2.41	16.8	2.55	21.0
9	.....	.....	2.40	16.4	2.41	16.8	2.65	25.0
10	.....	.....	2.45	18.0	2.36	15.3	2.90	34.0
11	.....	.....	2.50	19.6	2.40	16.4	2.80	30.0
12	.....	.....	2.40	16.4	2.50	19.6	2.65	26.0
13	.....	.....	2.35	15.0	2.55	21.0	2.60	23.0
14	.....	.....	2.50	19.6	2.40	16.4	2.55	21.0
15	.....	.....	2.60	23.0	2.45	18.0	2.55	21.0
16	.....	.....	2.30	13.6	2.50	19.6	2.50	19.6
17	.....	.....	2.30	13.6	2.30	13.6	2.55	21.0
18	.....	.....	2.20	11.0	2.30	13.6	2.65	25.0
19	.....	.....	2.20	11.0	2.25	12.3	2.75	28.0
20	.....	.....	2.15	9.8	2.25	12.3	2.85	32.0
21	2.87*g*	28.0*e*	2.20	11.0	2.30	13.6	3.05	40.0
22	2.80	27.0*e*	2.20	11.0	2.30	13.6	2.95	36.0
23	2.70	25.0*e*	2.10	8.6	2.40	16.4	2.80	30.0
24	2.55	18.0*e*	2.10	8.6	2.50	19.6	2.65	25.0
25	2.70	25.0*e*	2.15	9.8	2.50	19.6	2.70	26.0
26	2.70	25.0*e*	2.20	11.0	2.55	21.0	2.62	24.0
27	2.60	22.0*e*	2.20	11.0	2.70	26.0	3.15	44.0
28	2.60	22.0*e*	2.25	12.3	2.80	30.0	3.60	62.0
29	2.65	24.0*e*	2.30	13.6	2.95	36.0	3.20	46.0
30	2.60	22.0*e*	2.40	16.4	3.05	40.0	3.10	42.0
31	2.65	24.0*e*	.....	.....	2.90	34.0	.....	.....

g-g Gauge heights affected by ice.
e Discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of Cow creek near Cowley, for 1916—*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.90	34.0	1.95	5.6	1.85	4.0	1.85	4.00
2	3.65	64.0	1.90	4.8	1.90	4.8	1.90	4.80
3	3.15	44.0	1.95	5.6	1.95	5.6	1.90	4.80
4	2.95	36.0	1.90	4.8	2.60	23.0	1.95	5.60
5	2.65	25.0	1.90	4.8	2.50	19.6	1.85	4.00
6	2.68	26.0	1.90	4.8	1.90	4.8	1.90	4.80
7	2.45	18.0	1.89	4.6	1.85	4.0	1.92	5.00
8	2.55	21.0	1.85	4.0	1.85	4.0	1.65	1.55
9	2.50	19.6	2.35	15.0	1.85	4.0	1.60	1.05
10	2.45	18.0	2.20	11.0	1.90	4.8	1.85	4.00
11	2.45	18.0	2.10	8.6	1.85	4.0	1.80	3.30
12	2.45	18.0	1.95	5.6	1.80	3.3	1.80	3.30
13	2.48	18.9	1.85	4.0	1.80	3.3	1.80	3.30
14	2.40	16.4	2.10	8.6	1.85	4.0	1.80	3.30
15	2.30	13.6	2.00	6.6	1.85	4.0	1.78	3.00
16	2.28	13.1	1.90	4.8	1.85	4.0	1.75	2.60
17	2.35	15.0	1.85	4.0	1.85	4.0	1.80	3.30
18	2.35	15.0	1.90	4.8	1.85	4.0	1.85	4.00
19	2.28	13.1	2.00	6.6	1.80	3.3	1.80	3.30
20	2.20	11.0	1.90	4.8	1.80	3.3	1.85	4.00
21	1.98	6.1	1.90	4.8	1.80	3.3	1.90	4.80
22	2.05	7.6	1.85	4.0	1.80	3.3	1.85	4.00
23	2.00	6.6	1.85	4.0	1.80	3.3	1.85	4.00
24	2.02	7.0	1.80	3.3	1.80	3.3	1.90	4.80
25	2.00	6.6	1.85	4.0	1.80	3.3	1.80	3.30
26	2.05	7.6	1.95	5.6	1.80	3.3	1.80	3.30
27	2.08	8.2	1.90	4.8	1.80	3.3	1.95	5.60
28	2.05	7.6	1.90	4.8	1.85	4.0	1.95	5.60
29	2.03	7.2	1.85	4.0	1.85	4.0	1.90	4.80
30	2.05	7.6	1.85	4.0	1.80	3.3	1.85	4.00
31	2.05	7.6	1.85	4.0	.....	.....	1.80	3.30

MONTHLY DISCHARGE of Cow creek near Cowley, for 1916

(Drainage area 29 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (21-31)	28.0	18.00	24.0	0.828	0.34	524
April	23.0	8.60	13.8	0.476	0.53	821
May	40.0	12.30	19.7	0.679	0.79	1,211
June	62.0	19.60	30.0	1.030	1.15	1,785
July	64.0	6.10	17.3	0.597	0.69	1,064
August	15.0	3.30	5.5	0.190	0.22	338
September	23.0	3.30	5.0	0.172	0.19	298
October	5.6	1.05	3.9	0.134	0.15	240
The period	.....	.....	.....	.....	4.06	6,281

MEAN MONTHLY DISCHARGE in Second-feet, of Cow creek near Cowley

MONTH	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	3.50	1.01	6.4	3.60	1.72	3.90	4.3	3.9	3.5	218
November	.....	.....	.....	2.7*c*	5.60*e*	.....	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
March	.....	.....	.....	.....	.....	5.20*g*	14.6*h*	24.0*i*	.....	.....	.....
April	.....	.....	17.80*b*	17.3*d*	28.30*f*	17.10	9.0	13.8	.....	13.3	792
May	.....	6.60*a*	27.80	11.8	20.10	13.10	31.0	19.7	.....	21.0	1,266
June	.....	3.70	15.00	8.8	17.00	9.70	37.0	30.0	.....	17.3	1,028
July	.....	0.96	2.80	8.2	5.00	4.30	21.0	17.3	.....	8.5	523
August	12.4	0.36	7.40	4.9	2.10	1.91	6.2	5.5	.....	5.1	314
September	4.6	0.66	10.60	3.3	1.43	1.78	3.5	5.0	.....	3.9	230
Total in acre-ft.	1,036	617	4,595	3,535	4,113	3,169	7,285	6,305	.....	.....	4,371

a 26-31.
b 12-30.
c 1-11.
d 7-30.
e 1-15.
f 14-30.
g 15-31.
h 14-31.
i 21-31.

HUFF DITCH NEAR COWLEY

Location.—On the NW. ¼ Sec. 30, Tp. 8, Rge. 1, W. 5th Mer.
Records available.—May 10, 1915, to October 31, 1916.
Gauge.—Vertical staff; zero elevation maintained at 95.41 feet since establishment.
Bench-mark.—Nail on post 175 feet west of gauge; assumed elevation 100.00 feet.
Discharge measurements.—Made by wading with current-meter, or with weir.
Observer.—W. H. Connor.
Remarks.—Station visited nine times during open water season; no water used.

ELTON DITCH FROM TODD CREEK

Location.—On SW. ¼ Sec. 19, Tp. 8, Rge. 1, W. 5th Mer., on Elton's ranch, seven miles north of Cowley.
Records available.—June 6, 1914, to October 31, 1916.
Gauge.—Vertical staff. Zero elevation of gauge 103.07 referred to permanent iron bench-mark at Todd Creek station.
Bench-mark.—Two spikes in a post 150 feet south of the gauge, elevation 1.66 feet above the zero of the gauge. These spikes have elevation of 104.73 feet referred to permanent iron bench-mark at station on Todd creek, assumed elevation of which is 100.00 feet.
Channel.—Clay and fairly permanent.
Discharge measurements.—Made by wading.
Observer.—Cecil Elton.

DISCHARGE MEASUREMENTS of Elton ditch from Todd creek, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 21	J. M. Paul	.....	.....	.....	Dry	Nil
April 11	do	2.0	0.60	0.48	2.11	0.29
May 11	W. M. Edwards	.....	.....	.....	.....	0.20*e*
June 7	do	2.5	1.47	0.93	2.37	1.37
June 26	W. H. Hannan	2.0	0.64	0.50	2.07	0.32
July 6	W. M. Edwards	.....	.....	.....	2.05	0.30*e*
Aug. 9	do	.....	.....	.....	Dry	Nil
Sept. 7	do	.....	.....	.....	do	do
Nov. 21	do	.....	.....	.....	do	do

e Discharge estimated from field inspection.

DAILY GAUGE HEIGHT AND DISCHARGE of Elton ditch from Todd creek, for 1916

DAY	May		June		July	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			2.11	0.37	2.11	0.37
2			2.10	0.35	2.12	0.40
3			2.10	0.35	2.12	0.40
4			2.09	0.33	2.11	0.37
5			2.09	0.33	2.07	0.29
6			2.10	0.35	2.05	0.25
7			2.33*h*	1.17	2.05	0.25
8			2.60	2.60	2.03	0.22
9			2.61	2.70	2.02	0.21
10			2.61	2.70	2.00	0.18
11			2.62	2.70	2.01	0.19
12			2.61	2.70	2.00	0.18
13			2.61	2.70	2.02	0.21
14			2.63	2.80	2.00	0.18
15			2.63	2.80	2.00	0.18
16				2.70	1.97	0.14
17			2.59	2.60	1.97	0.14
18			2.38*h*	1.42	2.00	0.18
19			2.18	0.56	1.99	0.17
20			2.20	0.62	1.97	0.14
21			2.19	0.59	1.97	0.14
22			2.18	0.56	1.97	0.14
23			2.17	0.53	1.96	0.13
24	2.07	0.29	2.15	0.47	1.96	0.13
25	2.08	0.31	2.07	0.29	1.97	0.14
26	2.09	0.33	2.07	0.29	2.00	0.18
27	2.09	0.33	2.09	0.33	1.98	0.16
28	2.09	0.33	2.09	0.33	1.98	0.16
29	2.11	0.37	2.12	0.40	1.98	0.16
30	2.10	0.35	2.11	0.37	1.98	0.16
31	2.11	0.37				

h-h Head-gate opened; flow during other part of season due to leakage past head-gate.

MONTHLY DISCHARGE of Elton ditch from Todd creek, for 1916

MONTH	DISCHARGE IN SECOND-FEET			Total Discharge in acre-ft.
	Maximum	Minimum	Mean	
May (24-31)	0.37	0.29	0.34	5.4
June	2.80	0.29	1.23	73.0
July (1-30)	0.40	0.13	0.20	11.9
The period				90.3

TODD CREEK AT ELTON'S RANCH

Location.—On SW. ¼ Sec. 19, Tp. 8, Rge. 1, W. 5th Mer., near Cecil Elton's house, seven miles north of Cowley.

Records available.—August 20, 1908, to October 31, 1916.

Gauge.—Vertical staff. Elevation of zero maintained at 93.30 feet during 1909-11. Elevation of zero maintained at 93.02 feet during 1912-16.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—Sand and gravel, quite permanent.

Discharge measurements.—Are made from a foot-bridge during high water, and by wading during low stages.

Winter flow.—No discharge measurements are made during the winter season.

Observer.—C. W. S. Elton.

DISCHARGE MEASUREMENTS of Todd creek at Elton's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 21	J. M. Paul	19.0	20.4	1.59	4.30	32.0
April 11	do	19.5	28.0	1.39	3.27	39.0
May 11	W. M. Edwards	21.0	29.1	1.31	3.16	38.0
June 7	do	20.0	33.8	1.78	3.42	60.0
June 26	W. H. Hannan	21.0	35.2	1.85	3.47	64.0
July 6	W. M. Edwards	19.0	33.3	2.05	3.53	68.0
Aug. 9	do	19.5	22.6	0.85	2.95	19.0
Sept. 7	do	20.5	20.8	0.58	2.75	12.1
Nov. 21	do	15.0	10.6	1.03	3.00	10.9

DAILY GAUGE HEIGHT AND DISCHARGE of Todd creek at Elton's ranch, for 1916

Day	February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			5.33		3.30		3.22	42	3.53	68
2			5.33		3.43		3.26	45	3.52	67
3			5.33		3.25		3.18	39	3.46	62
4			5.33		3.20		3.14	36	3.36	53
5			5.41		3.16		3.14	36	3.38	55
6			5.49		3.12[b]		3.14	36	3.42	58
7			5.49		3.12	34	3.20	40	3.38	55
8			5.54		3.23	43	3.20	40	3.36	53
9			7.17		3.28	47	3.16	37	3.34	52
10			8.04		3.24	44	3.15	37	3.36	53
11			6.89		3.10	33	3.14	36	3.42	58
12			6.57		3.17	38	3.22	42	3.40	57
13			6.23		3.14	36	3.32	50	3.40	57
14			5.91		3.16	37	3.30	48	3.38	55
15			5.35		3.20	40	3.24	44	3.36	53
16	10.04[b]		5.11		3.12	34	3.20	40	3.35	52
17	6.87		4.91		3.18	39	3.18	39	3.40	57
18	6.68		4.81		3.16	37	3.15	37	3.50	65
19	6.37		4.69		3.12	34	3.14	36	3.55	70
20	5.49		4.58		3.11	34	3.14	36	3.65	80
21	5.64		4.59		3.02	27	3.12	34	3.76	91
22	5.79		4.61		3.02	27	3.12	34	3.75	90
23	5.37		4.24		2.99	25	3.15	37	3.65	80
24	5.40		4.05		2.98	24	3.19	40	3.56	71
25	5.38		4.01		2.97	24	3.24	44	3.55	70
26	5.34		4.04		3.02	27	3.34	52	3.46	62
27	5.30		3.77		3.00	26	3.35	52	3.59	74
28	5.27		3.77		3.08	32	3.35	52	3.66	81
29	5.33		3.61		3.10	33	3.61	76	4.13	130
30			3.75		3.14	36	3.56	71	4.05	121
31			3.43				3.59	74		

[b-b] Ice conditions and water on ice, so discharge cannot be computed.

DAILY GAUGE HEIGHT AND DISCHARGE of Todd creek at Elton's ranch, for 1916—*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.78	93	2.92	21.0	2.70	8.2	2.68	7.20
2	3.80	95	2.90	19.3	2.71	8.7	2.71	8.70
3	4.04	120	2.88	18.0	2.72	9.2	2.70	8.20
4	3.85	100	2.87	17.3	2.94	22.0	2.69	7.70
5	3.70	84	2.84	15.5	3.05	29.0	2.72	9.20
6	3.59	74	2.86	16.7	2.88	18.0	2.74	10.30
7	3.50	65	2.86	16.7	2.78	12.4	2.77	11.80
8	3.40	57	2.87	17.3	2.73	9.8	2.75	10.80
9	3.34	52	2.90	19.3	2.70	8.2	2.72	9.20
10	3.30	48	3.00	26.0	2.70	8.2	2.70	8.20
11	3.30	48	2.98	24.0	2.69	7.7	2.70	8.20
12	3.34	52	2.90	19.3	2.68	7.2	2.67	6.80
13	3.27	46	2.86	16.7	2.70	8.2	2.66	6.30
14	3.24	44	2.84	15.5	2.70	8.2	2.65	5.80
15	3.23	43	2.84	15.5	2.70	8.2	2.65	5.80
16	3.22	42	2.80	13.4	2.69	7.7	2.65	5.80
17	3.16	37	2.74	10.3	2.68	7.2	2.66	6.30
18	3.15	37	2.87	17.3	2.69	7.7	2.66	6.30
19	3.13	35	2.80	13.4	2.68	7.2	2.66	6.30
20	3.10	33	2.79	12.9	2.66	6.3	2.67	6.80
21	3.07	31	2.74	10.3	2.66	6.3	2.68	7.20
22	3.06	30	2.70	8.2	2.68	7.2	2.72	9.20
23	3.01	27	2.70	8.2	2.70	8.2	2.71	8.70
24	3.00	26	2.70	8.2	2.68	7.2	2.68	7.20
25	3.00	26	2.71	8.7	2.68	7.2	2.65	5.80
26	3.07	31	2.74	10.3	2.66	6.3	2.66	6.30
27	3.04	29	2.70	8.2	2.65	5.8	2.66	6.30
28	3.01	27	2.68	7.2	2.66	6.3	2.65	5.80
29	2.98	24	2.68	7.2	2.68	7.2	2.68	7.20
30	2.95	23	2.69	7.7	2.68	7.2	2.56	1.48
31	2.94	22	2.68	7.2	.....	.....	2.61	3.90

MONTHLY DISCHARGE of Todd creek at Elton's ranch, for 1916

(Drainage area 57 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
April	47.0	24.00	34.0	0.596	0.53	1,285
May	76.0	34.00	44.0	0.772	0.89	2,705
June	130.0	52.00	68.0	1.190	1.33	4,046
July	120.0	22.00	48.0	0.842	0.97	2,951
August	26.0	7.20	14.2	0.249	0.29	873
September	29.0	5.80	9.3	0.016	0.02	553
October	11.8	1.48	7.3	0.013	0.01	449
The period	.....	.....	.....	.....	4.04	13,184

MEAN MONTHLY DISCHARGE in Second-feet, of Todd creek at Elton's ranch

MONTH	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	6.7	3.3	15.1	8.5	5.8	9.6	12.7	7.3	8.6	531
November	.....	.....	.....	13.9*b*	10.4*d*	.....	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
March	.....	.....	.....	.....	.....	6.5*f*	63.0*g*	.....	.....	.....	.....
April	.....	9.8	31.0*a*	25.0*c*	45.0*e*	29.0	19.8	34.0	.....	23.0	1,194
May	.....	19.2	52.0	23.0	44.0	23.0	65.0	44.0	.....	39.0	2,369
June	.....	10.9	43.0	20.0	43.0	20.0	85.0	68.0	.....	41.0	2,463
July	.....	3.7	13.9	21.0	14.0	10.0	57.0	48.0	.....	24.0	1,475
August	19.8	2.1	18.4	14.4	7.3	6.1	16.4	14.2	.....	12.3	758
September	7.7	3.2	22.0	9.6	4.9	5.7	11.1	9.3	.....	9.2	548
Total in acre-ft.	1,678	3,371	10,201	7,306	8,801	6,220	17,995	13,194	.....	.....	9,338

a 16-30.
b 1-4.
c 12-30.
d 1-15.
e 18-30.
f 16-31.
g 16-31.

OLDMAN RIVER NEAR COWLEY

Location.—On the NE. ¼ of Sec. 34, Tp. 7, Rge. 1, W. 5th Mer.

Records available.—June 17, 1908, to December 31, 1916. One discharge measurement in 1907.

Gauge.—Vertical staff; elevation of zero maintained at 92.08 feet since establishment.

Bench-mark.—Permanent iron bench-mark on right bank; assumed elevation 100.00 feet.

Channel.—Rock and gravel.

Discharge measurements.—Made with current-meter from cable car at ordinary stages and by wading at low water.

Observer.—Archie McKay.

DISCHARGE MEASUREMENTS of Oldman river near Cowley, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 13	W. R. McCaffrey	105	105.0	1.18	2.57*b*	124
Jan. 29	H. W. Rowley	90	76.0	1.59	2.65*b*	121
Feb. 12	do	100	61.5	1.44	2.52*b*	88
Feb. 19	J. E. Caughey	97	170.0	2.32	1.83*b*	420
Feb. 26	H. W. Rowley	88	142.0	1.40	1.36	199
Mar. 21	J. M. Paul	185	217.0	2.15	1.79	466
April 13	do	171	220.0	2.11	1.85	465
May 16	W. M. Edwards	185	285.0	2.21	2.24	829
June 13	do	200	528.0	5.12	3.52	2,702
June 22	W. H. Hannan	203	700.0	5.71	4.22	3,996
June 24	do	199	596.0	5.32	3.70	3,169
June 28	do	202	657.0	5.78	4.14	3,793
June 30	do	201	637.0	6.16	4.12	3,928
July 12	W. M. Edwards	197	424.0	4.53	3.06	1,909
Aug. 8	do	183	192.0	2.24	1.83	431
Sept. 5	do	188	256.0	2.76	2.19	707
Oct. 14	E. J. Switzer	181	156.0	1.82	1.53	284
Nov. 20	W. M. Edwards	187	146.0	1.08	2.17*b*	158
Dec. 9	do	176	95.2	1.04	1.89*b*	99
Dec. 29	E. J. Switzer	103	72.0	1.53	2.15*b*	110

b Ice conditions.

DAILY GAUGE HEIGHT AND DISCHARGE of Oldman river near Cowley, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.94*b*	103	2.85	110	1.05	75	2.50	1,134	2.30	896	2.84	1,576
2	3.00	97	3.00	106	1.10	92	2.46	1,084	2.60	1,258	2.92	1,690
3	3.02	92	2.65	102	1.20	131	2.30	896	2.64	1,308	2.94	1,721
4	3.10	90	2.85	98	1.25	152	2.32	919	2.80	1,521	3.48	2,624
5	3.15	88	3.05	92	1.35	197	1.52	278	2.92	1,690	3.62	2,876
6	3.18	88	2.95	91	1.60	317	1.55	292	3.10	1,974	3.51	2,678
7	3.20	91	2.95	90	1.80	431	1.63	332	3.12	2,006	3.54	2,732
8	3.20	95	3.00	88	1.60	317	1.90	500	3.00	1,814	3.64	2,912
9	3.13	101	2.75	88	1.80	431	1.92	516	2.94	1,721	3.80	3,200
10	3.05	107	2.80	88	2.00	585	1.92	516	2.78	1,494	3.62	2,776
11	3.15	112	2.55	88	2.30	896	1.93	524	2.58	1,233	3.51	2,678
12	3.10	118	2.52	88	2.30	896	1.88	486	2.48	1,109	3.50	2,660
13	2.58	124	2.55	120	1.85	465	1.82	445	2.30	896	3.52	2,696
14	3.05	132	2.55	640	1.90	500	1.84	458	2.31	907	3.92	3,421
15	3.10	132	4.50*b*	1,210	1.85	465	2.02	603	2.29	885	4.17	3,894
16	3.15	128	3.35	2,390	1.68	359	1.96	549	2.23	818	4.34	4,228
17	2.35	122	2.15	730	1.85	465	1.94	532	2.22	806	4.87	5,288
18	2.75	118	2.05	630	2.00	585	1.85	465	2.35	953	4.72	4,988
19	3.15	114	2.10	680	1.65	342	1.74	394	2.44	1,060	5.22	5,988
20	3.25	112	3.61	2,858	1.89	493	1.82	445	2.94	1,721	4.81	5,168
21	3.65	114	3.63	2,894	1.90	500	1.84	458	2.94	1,721	4.92	5,388
22	3.05	118	3.43	2,534	1.90	500	1.80	431	2.92	1,690	4.42	4,388
23	.....	122*e*	3.38	2,444	1.80	431	1.82	445	2.96	1,752	4.07	3,702
24	.....	125*e*	3.13	2,023	1.89	493	1.92	516	2.98	1,783	4.17	3,894
25	.....	128*e*	2.73	1,426	1.79	425	2.00	585	2.99	1,798	3.77	3,146
26	.....	129*e*	1.36	202	1.80	431	2.40	1,010	3.01	1,830	3.62	2,876
27	.....	129*e*	1.09	89	1.98	567	2.50	1,134	3.01	1,830	3.90	3,384
28	.....	126*e*	1.12	100	1.80	431	2.64	1,308	2.84	1,576	4.17	3,894
29	2.60	121	1.10	92	1.95	540	2.69	1,373	2.92	1,690	4.24	4.029
30	.....	118*e*	.....	.....	1.65	342	2.00	585	2.94	1721	4.12	3,798
31	.....	114*e*	.....	.....	1.80	431	.....	.....	2.92	1,690	.....	.....

b–b Ice conditions.
e Discharge estimated

DAILY GAUGE HEIGHT AND DISCHARGE of Oldman river near Cowley, for 1916—*Concluded*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1....	3.97	3,513	2.06	640	1.80	431	1.57	302	1.52	278	1.92	122
2....	4.44	4,428	2.02	603	1.82	445	1.64	337	1.60	317	1.97	120
3....	4.47	4,488	1.97	558	1.92	516	1.59	312	1.62	327	1.93	116
4....	4.27	4,088	1.97	558	2.28	874	1.55	292	1.62	327	2.02	111
5....	3.87	3,329	1.97	558	2.35	953	1.50	268	1.67	354	1.97	108
6....	3.82	3,237	1.94	532	2.21	795	1.51	273	1.62	327	1.97	105
7....	3.75	3,110	2.02	603	2.21	795	1.53	282	1.37	206	1.92	102
8....	3.54	2,732	2.07	650	2.19	773	1.51	273	1.40*b*	197	1.68	100
9....	3.30	2,305	1.98	567	2.17	752	1.59	312	1.52	193	1.89	99
10....	3.30	2,305	2.02	603	1.99	576	1.60	317	1.62	187	2.03	98
11....	3.24	2,204	2.00	585	1.91	508	1.63	332	1.52	184	1.98	98
12....	2.97	1,767	1.94	532	1.81	438	1.61	322	1.52	179	2.08	97
13....	2.92	1,690	2.00	585	1.79	425	1.67	354	1.52	177	2.08	97
14....	2.82	1,549	1.92	516	1.71	377	1.53	282	1.57	174	2.08	96
15....	2.76	1,467	1.90	500	1.71	377	1.55	292	1.58	169	2.08	95
16....	2.62	1,283	1.82	445	1.75	400	1.56	297	1.52	168	2.03	94
17....	2.56	1,208	1.80	431	1.70	371	1.54	287	1.62	164	2.08	93
18....	2.52	1,159	1.90	500	1.71	377	1.53	282	1.60	162	2.18	92
19....	2.56	1,208	1.80	431	1.63	334	1.52	278	1.58	160	2.18	91
20....	2.51	1,246	1.79	425	1.67	354	1.57	302	1.82	158	2.23	91
21....	2.43	1,047	1.80	431	1.61	322	1.61	322	1.87	155	2.18	91
22....	2.42	1,035	1.81	438	1.60	311	1.61	322	1.87	151	2.08	92
23....	2.33	930	1.80	431	1.61	322	1.51	273	1.92	148	2.18	92
24....	2.32	919	1.81	438	1.69	365	1.47	254	1.87	146	2.08	94
25....	2.22	806	1.77	412	1.63	332	1.51	273	1.91	144	2.08	97
26....	2.22	806	1.80	431	1.61	322	1.45	244	1.92	140	1.98	100
27....	2.21	795	1.72	383	1.61	322	1.42	230	1.92	137	2.08	102
28....	2.18	762	1.70	371	1.61	322	1.43	234	1.87	133	2.13	105
29....	2.14	720	1.69	365	1.59	312	1.51	273	1.92	128	2.13	110
30....	2.14	720	1.66	348	1.61	322	1.48	258	1.87	126	2.08	112
31....	2.14	720	1.60	317	.....	.....	1.51	273	.....	.....	2.13*b*	111

b-b Ice conditions.
e Discharge estimated.

MONTHLY DISCHARGE of Oldman river near Cowley, for 1916

(Drainage area 800 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	132	88	92	0.115	0.13	5,657
February	2,894	88	762	0.952	1.03	43,831
March	896	75	428	0.535	0.62	26,317
April	1,373	278	640	0.800	0.89	38,083
May	2,006	806	1,747	2.180	2.51	107,393
June	5,988	1,576	3,476	4.340	4.84	206,787
July	4,488	720	1,857	2.380	2.74	114,155
August	650	317	490	0.612	0.71	30,129
September	953	311	471	0.589	0.66	28,026
October	354	230	289	0.362	0.42	17,770
November	354	126	194	0.242	0.27	11,544
December	122	91	101	0.126	0.14	6,210
The year	.....	.....	.....	.....	14.96	635,902

MEAN MONTHLY DISCHARGE in Second-feet, of Oldman river near Cowley

MONTH	1907–8	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	181	178	324	371	223	283	449	407	289	301	18,482
November	.....	.....	.....	*d*274	266	204	255	375	322	194	186	16,026
December	.....	.....	.....	.....	182	147	176	155	149	101	152	9,326
January	.....	.....	.....	97	84	112	122	172	92	.....	113	6,965
February	.....	.....	.....	117	85	116	90	106	762	.....	213	12,095
March	.....	.....	.....	110	*e*88	104	97	105	428	.....	169	10,379
April	.....	.....	.....	369	540	714	372	494	640	.....	522	31,032
May	.....	1,433	*c*1,250	1,262	826	1,709	1,346	2,306	1,747	.....	1,518	93,354
June	*a*2,167	3,386	826	2,052	3,058	1,720	1,275	2,450	3,476	.....	2,280	135,689
July	956	*b*1,381	324	565	1,079	601	605	1,341	1,857	.....	916	56,313
August	311	682	191	809	557	548	270	693	490	.....	506	31,091
September	186	252	213	996	253	333	202	401	471	.....	367	21,868
Total in acre-ft.	149,146	423,400	139,137	473,588	443,240	394,993	308,411	548,274	653,725	.....	.....	442,620

a 17-30.
b 1-24.
c 18-31.
d 1-28.
e 1-15.

CARBONDALE CREEK AT EVANS' RANCH

Location.—SE. ¼ Sec. 15, Tp. 6, Rge. 3, W. 5th Mer.
Records available.—April 19, 1916, to December 15, 1916.
Gauge.—Enamel staff, graduated in feet and hundredths; elevation of zero 95.22.
Bench-mark.—Spike in tree on right bank and fifteen feet from gauge; assumed elevation 100.00 feet.
Channel.—May shift to a slight extent.
Discharge measurements.—With current-meter by cable at high stages, and wading at low stages.
Winter flow.—Station not maintained during winter.
Observer.—J. H. Davison.

DISCHARGE MEASUREMENTS of Carbondale creek at Evans' ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 19	J. M. Paul	85	114.0	2.18	0.86	249
May 15	W. M. Edwards	94	146.0	2.40	1.10	349
June 12	do	.....	.....	.....	2.30	.....*x*
July 10	do	.....	.....	.....	1.85	.....*x*
Aug. 7	do	82	77.6	1.80	0.40	140
Sept. 2	do	80	61.6	1.36	0.17	84
Nov. 23	do	43	24.9	1.17	0.05	29
Dec. 12	do	46	27.3	0.85	0.05	23

x Too deep to make wading measurement.

DAILY GAUGE HEIGHT AND DISCHARGE of Carbondale creek at Evans' ranch, for 1916

DAY	April		May		June		July	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	1.28	365	1.62	460	2.25	648
2	.....	.....	1.23	351	1.55	440	2.75	798
3	.....	.....	1.86	531	2.00	573	2.62	759
4	.....	.....	2.43	702	2.73	792	2.24	645
5	.....	.....	2.64	765	2.66	771	2.30	663
6	.....	.....	2.67	774	2.54	735	2.26	651
7	.....	.....	2.50	723	2.52	729	2.00	573
8	.....	.....	2.12	609	2.66	771	2.00	573
9	.....	.....	1.85	528	2.60	753	1.95	558
10	.....	.....	1.55	440	2.71	786	1.85	528
11	.....	.....	1.41	401	2.43	702	1.82	519
12	.....	.....	1.33	378	2.30	663	1.70	483
13	.....	.....	1.21	346	2.54	735	1.65	468
14	.....	.....	1.15	330	2.94	855	1.44	409
15	.....	.....	1.10	316	3.25	948	1.41	401
16	.....	.....	.....	324*e*	3.45	1,008	1.38	392
17	.....	.....	1.16	332	3.50	1,023	1.35	384
18	.....	.....	1.23	351	3.42	999	1.17	335
19	0.86	253	1.55	440	3.51	1,026	1.15	330
20	0.85	250	1.63	463	3.55	1,038	1.12	321
21	0.84	248	1.76	501	3.60	1,053	1.00	289
22	0.75	226	1.71	486	3.20	933	0.92	268
23	0.74	223	1.52	432	2.51	726	0.88	258
24	0.77	230	1.40	398	2.43	702	0.85	250
25	0.80	238	1.35	384	2.40	693	0.82	243
26	1.10	316	1.26	359	2.42	699	0.80	238
27	1.56	443	1.63	463	2.50	723	0.80	238
28	1.58	448	2.10	603	2.65	768	0.78	233
29	1.41	401	1.81	516	2.73	792	0.69	210
30	1.25	356	1.70	483	2.15	618	0.67	206
31	.....	.....	1.74	495	.....	.....	0.55	176

Discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of Carbondale creek at Evans' ranch, for 1916.—*Concluded.*

DAY	August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft*
1	0.52	168	0.18	86	0.00	46	0.05	57	0.00	46
2	0.50	163	0.17	84	0.00	46	0.06	59	0.01	48
3	0.51	166	0.17	84	0.00	46	0.09	66	0.01	48
4	0.49	161	0.93	271	0.00	46	0.08	64	0.07	61
5	0.42	144	0.70	213	0.00	46	0.06	59	0.11	70
6	0.40	139	0.66	203	0.02	50	0.05	57	0.15	80
7	0.40	139	0.52	168	0.01	48	0.02	50	0.10	68
8	0.39	137	0.41	141	0.01	48	0.05	57	0.07	61
9	1.00	289	0.35	127	0.01	48	0.04	55	.....	59*e*
10	1.32	376	0.30	115	0.01	48	0.04	55	.....	57*e*
11	1.10	316	0.29	113	0.01	48	0.09	66	0.04	55
12	0.90	263	0.21	93	0.01	48	0.12	73	0.05	57
13	0.62	193	0.22	96	0.01	48	0.19	89	0.10	68
14	0.51	166	0.25	103	0.03	53	0.25	103	0.14	77
15	0.50	163	0.23	98	0.05	57	0.27	108	0.21	93
16	0.46	153	.....	96*e*	0.04	55	.....	117*e*	.....	.....
17	0.41	141	0.21	93	0.01	48	0.75	226	.....	.....
18	0.59	186	0.18	86	0.03	53	0.57	180	.....	.....
19	0.45	151	0.15	80	0.03	53	0.24	101	.....	.....
20	0.41	141	0.13	75	0.03	53	0.18	86	.....	.....
21	0.40	139	0.11	70	0.00	46	0.13	75	.....	.....
22	0.36	129	0.10	68	0.00	46	0.08	64	.....	.....
23	0.34	125	0.08	64	0.00	46	0.05	57	.....	.....
24	0.33	122	0.07	61	0.00	46	0.07	61	.....	.....
25	0.31	117	0.05	57	0.00	46	0.03	53	.....	.....
26	0.30	115	0.05	57	0.00	46	0.01	48	.....	.....
27	0.30	115	0.04	55	0.02	50	0.00	46	.....	.....
28	0.29	113	0.02	50	0.10	68	.....	46*e*	.....	.....
29	0.25	103	0.00	46	0.09	66	.....	46*e*	.....	.....
30	0.20	91	0.00	46	0.07	61	0.00	46	.....	.....
31	0.19	89	.....	.....	0.05	57	.....	.....	.....	.....

e Discharge estimated.

MONTHLY DISCHARGE of Carbondale creek, at Evans' ranch, for 1916

(Drainage area 143 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
April (19-31)	448	223	303	2.120	0.95	7,210
May	774	316	471	3.290	3.79	28,960
June	1,053	440	784	5.480	6.11	46,651
July	798	176	421	2.940	3.39	25,886
August	376	89	162	1.130	1.30	9,961
September	271	46	100	0.699	0.78	5,950
October	68	46	51	0.357	0.41	3,136
November	226	46	76	0.531	0.59	4,522
December (1-15)	93	46	63	0.441	0.25	1,874
The period	.....	.....	.....	.....	17.57	134,150

CASTLE RIVER AT MCDONALD'S RANCH

Location.—SW ¼ Sec. 30, Tp. 6, Rge. 2, W. 5th Mer.

Records available.—Station established April 18, 1916, and records available from that date to December 12, 1916.

Gauge.—Enamel staff, graduated in feet, tenths and hundredths. The elevation of zero is maintained at 90.53 feet.

Bench-mark.—Spike in poplar tree on left bank of river, twenty feet from the gauge; assumed elevation 100.00 feet.

Channel.—One channel fairly permanent.

Discharge measurements.—Made with current-meter by wading at ordinary stages.

Winter flow.—Station not maintained during winter.

Observer.—George Lang.

DISCHARGE MEASUREMENTS of Castle river at McDonald's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 18	J. M. Paul				1.80	x
May 15	W. M. Edwards				2.12	x
June 12	do				3.55	x
July 10	do				3.43	x
Aug. 7	do	105	163	2.68	1.59	435
Sept. 2	do	81	112	1.92	1.28	215
Oct. 19	E. J. Switzer	107	116	1.36	1.01	157
Nov. 23	W. M. Edwards	70	86	1.34	1.10	116
Dec. 12	do	67	92	0.85	1.74	78

x Water too deep to make gauging.

DAILY GAUGE HEIGHT AND DISCHARGE of Castle river at McDonald's ranch, for 1916

Day	April		May		June		July	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			2.20	780	2.74	1,256	3.67	2,093
2			2.27	836	2.74	1,256	4.12	2,498
3			2.51	1,049	2.93	1,427	3.91	2,309
4			2.99	1,481	3.09	1,571	3.78	2,192
5			3.19	1,661	3.73	2,147	3.66	2,084
6			3.29	1,751	3.52	1,958	3.53	1,967
7			3.68	2,102	3.75	2,165	3.44	1,886
8			3.26	1,724	3.75	2,165	3.46	1,904
9			2.72	1,238	3.77	2,183	3.43	1,877
10			2.66	1,184	3.76	2,174	3.43	1,877
11			2.51	1,049	3.64	2,066	3.33	1,787
12			2.37	923	3.44	1,886	3.28	1,742
13			2.36	914	3.62	2,048	3.18	1,652
14			2.10	700	3.88	2,282	3.08	1,562
15			2.12	716	4.38	2,732	2.73	1,247
16			2.07	678	4.80	3,110	2.77	1,283
17			2.12	716	5.05	3,335	2.72	1,238
18	1.80	485	2.16	748	5.11	3,389	2.66	1,184
19	1.75	454	2.30	860	5.41	3,659	2.48	1,022
20		451	2.47	1,013	5.47	3,713	2.43	977
21	1.74	447	2.48	1,022	5.50	3,740	2.32	878
22	1.70	422	2.52	1,058	5.11	3,389	2.28	844
23	1.66	399	2.48	1,022	4.61	2,939	2.23	804
24	1.65	394	2.43	977	3.56	1,994	2.21	788
25	1.69	416	2.34	896	3.71	2,129	2.16	748
26	1.75	454	2.28	844	3.72	2,138	2.13	724
27	2.19	772	2.59	1,121	3.87	2,273	2.06	670
28	2.36	914	2.77	1,283	4.42	2,768	1.93	572
29	2.29	852	2.85	1,355	4.22	2,588	1.87	530
30	2.16	748	2.84	1,346	4.04	2,426	1.83	504
31			2.74	1,256			1.83	504

DAILY GAUGE HEIGHT AND DISCHARGE of Castle river at McDonald's ranch, for 1916.—*Concluded.*

DATE	August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.81	492	1.31	236	0.98	135	1.05	152	1.68	411
2	1.75	454	.....	230	0.99	138	1.05	152	1.69	416
3	1.72	435	1.28	225	0.96	130	1.05	152	1.70	422
4	1.68	411	1.80	485	0.96	130	1.05	152	1.70	422
5	1.68	411	1.70	422	1.02	145	1.04	150	1.71	428
6	1.68	411	1.65	394	1.05	152	0.90	115	1.71	428
7	1.54	335	1.55	340	1.06	155	0.94	125	1.73	441
8	1.50	315	1.52	325	1.09	162	0.94	125	1.76	460
9	2.00	625	1.49	310	1.08	160	0.98	135	1.77	466
10	1.95	588	1.45	292	1.08	160	1.05	152	1.77	466
11	1.70	422	1.40	270	1.06	155	1.01	142	1.74	447
12	1.65	394	1.35	251	1.06	155	1.01	142	1.74*x*	447
13	1.64	388	1.35	251	1.05	152	1.01	142	.....	.....
14	1.60	365	1.34	247	1.05	152	.....	228	.....	.....
15	1.55	340	2.29	852	1.03	148	1.50	315	.....	.....
16	1.53	330	2.29	852	1.01	142	1.50	315	.....	.....
17	1.50	315	1.26	218	.....	142	.....	245	.....	.....
18	1.63	382	1.24	211	1.01	142	1.13	175	.....	.....
19	1.60	365	1.24	211	1.01	142	1.13	175	.....	.....
20	1.53	330	1.20	197	1.01	142	1.09	162	.....	.....
21	1.50	315	1.16	184	1.00	140	1.07	158	.....	.....
22	1.50	315	1.16	184	0.99	138	1.07	158	.....	.....
23	1.45	292	1.16	184	0.98	135	1.10	165	.....	.....
24	1.42	279	1.09	162	0.98	135	1.19	194	.....	.....
25	1.40	270	1.06	155	0.98	135	1.19	194	.....	.....
26	1.43	284	1.05	152	0.98	135	1.20	197	.....	.....
27	1.40	270	1.01	142	1.03	148	1.34	247	.....	.....
28	1.40	270	1.01	142	1.02	145	1.40	270	.....	.....
29	1.38	262	1.00	140	.....	148	1.54	335	.....	.....
30	1.34	247	0.99	138	1.05	152	1.64	388	.....	.....
31	1.32	240	.....	.....	1.05	152	.....	.....	.....	.....

x Station discontinued December 12.

MONTHLY DISCHARGE of Castle River at McDonald's ranch, for 1916

(Drainage area 271 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
April (18-31)	914	394	554	2.040	0.99	14,282
May	2,102	678	1,107	4.080	4.70	68,051
June	3,740	1,256	2,430	8.970	10.01	144,561
July	2,498	504	1,353	4.990	5.75	83,173
August	625	240	360	1.330	1.53	22,135
September	852	138	280	1.030	1.15	16,661
October	162	130	145	0.535	0.62	8,916
November	388	115	192	0.708	0.79	11,425
December	466	411	438	1.620	0.72	10,423
The period	.....	.....	.....	.....	26.26	379,627

CANYON CREEK NEAR MOUNTAIN MILL

Location.—On the NE. ¼ Sec. 14, Tp. 6, Rge. 2, W. 5th Mer.

Records available.—April 10, 1911, to October 31, 1915. Discharge measurements only in 1910.

Gauge.—Vertical staff; elevation of zero 85.51 feet.

Bench-mark.—Spike in tree on left bank; assumed elevation 100.00 feet.

Channel.—Clean gravel and rock.

Discharge measurements.—During high stages made with current-meter at traffic bridge one-half mile up stream; at ordinary stages by wading below the gauge.

Winter flow.—Station not maintained during the winter.

Observer.—G. Biron.

DISCHARGE MEASUREMENTS of Canyon creek near Mountain Mill, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 22	J. M. Paul	24	24.80	1.92	5.05	48.0
April 12	do	25	28.20	2.02	5.25	57.0
May 13	W. M. Edwards	24	23.80	1.88	5.05	45.0
June 8	do	24	33.40	2.15	5.40	82.0
July 7	do	23	24.30	1.78	5.00	43.0
Aug. 5	do	7	4.90	1.64	4.33	8.0
Sept. 6	do	12	7.80	0.87	4.22	6.8
Nov. 22	do	6	3.40	1.16	4.20	3.9

DAILY GAUGE HEIGHT AND DISCHARGE of Canyon creek near Mountain Mill, for 1916

Day	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.20*b*	5.5	4.97	41	5.25	62	5.65	102
2	4.20	5.5	4.96	40	5.20	58	5.50	86
3	4.20	5.5	4.94	39	5.20	58	5.44	79
4	4.21	5.8	4.97	41	5.25	62	5.40	75
5	4.21	5.8	4.90	36	5.27	63	5.60	96
6	4.21	5.8	4.97	41	5.27	63	5.65	102
7	4.21	5.8	4.98	42	5.28	64	5.50	86
8	4.21	5.8	5.05	46	5.15	54	5.40	75
9	4.22	6.0	5.04	46	5.10	50	5.37	72
10	4.22	6.0	5.20	58	5.05	46	5.38	73
11	4.30*b*	8.0	5.23	60	5.02	44	5.32	68
12	4.35*g*	9.8	5.24	61	5.00	43	5.22	59
13	5.20	58.0	5.15	54	5.00	43	5.15	54
14	4.87	34.0	5.20	58	4.97	41	5.12	52
15	4.90	36.0	5.30	66	4.95	40	5.12	52
16	4.85	33.0	5.25	62	5.00	43	5.05	46
17	4.86	34.0	5.16	54	4.95	40	5.00	43
18	4.66	22.0	5.10	50	4.92	37	5.00	43
19	4.86	34.0	5.10	50	4.95	40	5.05	46
20	5.00	43.0	5.05	46	4.94	39	5.08	49
21	5.15	54.0	5.06	47	4.90	36	5.35	70
22	5.05	46.0	5.10	50	4.90	36	5.10	50
23	4.95	40.0	5.05	46	4.87	34	5.05	46
24	4.90	36.0	5.03	45	4.96	40	5.00	43
25	4.85*g*	33.0	5.01	44	5.05	46	4.96	40
26	4.87	34.0	5.05	46	5.04	46	4.95	40
27	4.95	40.0	5.05	46	5.30	66	5.05	46
28	4.87	34.0	5.10	50	5.55	91	5.15	54
29	4.75	27.0	5.15	54	5.50	86	5.25	62
30	4.81	31.0	5.10	50	5.65	102	5.15	54
31	4.90	36.0	.....	.....	5.55	91	.....	.....

b–b Ice conditions; discharge estimated.
g–g Gauge height affected by ice going out.

DAILY GAUGE HEIGHT AND DISCHARGE of Canyon creek near Mountain Mill, for 1916 —*Concluded*

Day	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	5.02	44.0	4.37	10.4	4.20	5.5	4.18	5.0
2	5.44	79.0	4.35	9.8	4.21	5.8	4.18	5.0
3	5.30	66.0	4.34	9.4	4.19	5.2	4.18	5.0
4	5.16	54.0	4.32	8.7	4.29	7.8	4.18	5.0
5	5.04	46.0	4.32	8.7	4.24	6.5	4.17	4.8
6	5.00	43.0	4.30	8.0	4.22	6.0	4.22	6.0
7	4.95	40.0	4.29	7.8	4.20	5.5	4.22	6.0
8	4.96	40.0	4.27	7.2	4.19	5.2	4.19	5.2
9	4.90	36.0	4.48	14.3	4.18	5.0	4.20	5.5
10	4.86	34.0	4.57	18.2	4.20	5.5	4.20	5.5
11	4.85	33.0	4.47	14.0	4.18	5.0	4.20	5.5
12	4.80	30.0	4.42	12.2	4.17	4.8	4.19	5.2
13	4.85	33.0	4.37	10.4	4.21	5.8	4.18	5.0
14	4.75	27.0	4.35	9.8	4.20	5.5	4.18	5.0
15	4.74	27.0	4.31	8.4	4.18	5.0	4.19	5.2
16	4.71	25.0	4.28	7.5	4.18	5.0	4.18	5.0
17	4.69	24.0	4.29	7.8	4.17	4.8	4.21	5.8
18	4.65	22.0	4.40	11.5	4.16	4.5	4.21	5.8
19	4.66	22.0	4.35	9.8	4.15	4.2	4.21	5.8
20	4.60	19.5	4.32	8.7	4.15	4.2	4.19	5.2
21	4.55	17.2	4.30	8.0	4.15	4.2	4.19	5.2
22	4.55	17.2	4.27	7.2	4.15	4.2	4.18	5.0
23	4.54	16.8	4.25	6.8	4.15	4.2	4.16	4.5
24	4.54	16.8	4.24	6.5	4.18	5.0	4.24	6.5
25	4.54	16.8	4.23	6.2	4.14	4.0	4.22	6.0
26	4.50	15.0	4.26	7.0	4.16	4.5	4.22	6.0
27	4.53	16.4	4.24	6.5	4.15	4.5	4.28	7.5
28	4.48	14.3	4.22	6.0	4.15	4.2	4.25	6.8
29	4.46	13.6	4.20	5.5	4.15	4.2	4.25	6.8
30	4.44	12.9	4.19	5.2	4.14	4.0	4.24	6.5
31	4.40	11.5	4.19	5.2	.....	.....	4.24	6.5

MONTHLY DISCHARGE of Canyon creek near Mountain Mill, for 1916

(Drainage area 27 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March	58.0	5.5	25.0	0.926	1.07	1,537
April	66.0	36.0	49.0	1.810	2.02	2,916
May	102.0	34.0	54.0	2.000	2.31	3,320
June	102.0	40.0	62.0	2.300	2.57	3,689
July	79.0	11.5	29.0	1.070	1.23	1,783
August	18.2	5.2	8.8	0.326	0.38	541
September	7.8	4.0	5.0	0.185	0.21	298
October	7.5	4.5	5.6	0.207	0.24	344
The period	.....	.....	.....	.....	10.03	14,428

MEAN MONTHLY DISCHARGE in Second-feet of Canyon creek near Mountain Mill

MONTH	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	20.0	4.6	3.4	15.0	14.9	5.6	10.6	654
November	.....	22.0*b*	6.1*c*	.....	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	.....	.....	.....	.....
March	.....	.....	.....	2.1*e*	7.0*f*	25.0	.....	25.0	1,537
April	49.0*a*	44.0	76.0*d*	23.0	21.0	49.0	.....	34.0	2,043
May	87.0	32.0	51.0	24.0	98.0	54.0	.....	58.0	3,541
June	52.0	14.4	19.7	12.7	76.0	62.0	.....	39.0	2,349
July	10.0	13.1	6.9	6.0	32.0	29.0	.....	16.2	994
August	13.0	5.4	3.9	3.1	16.3	8.8	.....	8.4	517
September	81.0	3.5	2.5	3.4	12.1	5.0	.....	17.9	1,062
Total in acre-feet	16,647	8,679	8,188	4,632	16,646	15,000	.....	.....	12,697

a 10-30.
b 1-15.
c 1-15.
d 14-30.
e 17-31.
f 15-31

MILL CREEK NEAR MOUNTAIN MILL

Location.—On the SW. ¼ Sec. 18, Tp. 6, Rge. 1, W. 5th Mer.
Records available.—July 7, 1910, to October 31, 1916.
Gauge.—Vertical staff; elevation of zero maintained at 93.41 feet since establishment.
Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.
Channel.—Coarse gravel.
Discharge measurements.—By wading with meter at ordinary stages and from bridge at flood stages.
Winter flow.—Station not maintained during the winter.
Observer.—K. B. Parsons.

DISCHARGE MEASUREMENTS of Mill creek near Mountain Mill, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 22	J. M. Paul	34	33.1	2.72	1.93	90*g*
April 12	do	42	41.4	2.90	2.03	120
May 13	W. M. Edwards	45	51.3	3.18	2.20	163
June 8	do	71	115.0	4.23	2.95	486
July 7	do	66	94.7	3.91	2.65	370
Aug. 5	do	37	30.4	1.98	1.69	60
Sept. 6	do	36	30.8	1.72	1.63	53
Nov. 22	do	45	23.0	1.04	2.30	24*i*

i Stream frozen over.
g Ice going out.

DAILY GAUGE HEIGHT AND DISCHARGE of Mill creek near Mountain Mill, for 1916

Day	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			1.92	96	2.25	180	2.75	397
2			1.83	81	2.25	180	2.79	415
3			1.82	79	2.35	218	2.86	448
4			1.83	81	2.55	305	3.26	632
5			1.78	73	2.55	305	3.32	659
6			1.83	81	2.55	305	3.21	609
7			1.85	84	2.59	323	2.95	489
8			1.87	87	2.65	351	3.05	535
9			2.07	129	2.55	305	3.10	558
10			2.08	131	2.44	255	3.00	512
11			2.12	141	2.40	237	2.92	475
12			2.03	119	2.25	180	2.90	466
13			2.04	122	2.22	170	2.90	466
14			2.05	124	2.20	163	2.95	489
15			2.07	129	2.19	160	3.20	604
16			2.01	114	2.15	150	3.31	655
17			2.00	112	2.15	150	3.35	673
18			1.96	104	2.15	150	3.35	673
19			1.93	98	2.15	150	3.30	650
20			1.90	92	2.25	180	3.36	678
21			1.95	102	2.35	218	3.35	673
22	1.93	98	1.92	96	2.30	198	3.04	580
23	1.95	102	1.90	92	2.25	180	2.95	489
24	1.92	96	1.85	84	2.25	180	2.95	489
25	1.82	79	1.85	84	2.25	180	2.95	489
26	1.81	78	2.00	112	2.40	237	2.95	489
27	1.82	79	2.05	124	2.85	443	3.00	512
28	1.78	73	2.14	147	2.85	443	3.05	535
29	1.77	72	2.23	174	2.98	503	3.10	558
30	1.79	75	2.25	180	2.85	443	3.10	558
31	1.77	72			2.81	425		

DAILY GAUGE HEIGHT AND DISCHARGE of Mill creek near Mountain Mill, for 1916—*Concluded*

Day	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-f*
1	3.09	553	1.51	42	1.55	46	1.49	40
2	3.24	622	1.49	40	1.60	50	1.50	41
3	3.24	622	1.46	38	1.65	56	1.48	39
4	3.04	530	1.47	39	1.66	57	1.48	39
5	2.94	484	1.56	46	1.66	57	1.48	39
6	2.79	415	1.50	41	1.63	54	1.49	40
7	2.73	388	1.46	38	1.61	51	1.50	41
8	2.96	494	1.40	34	1.60	50	1.52	43
9	2.83	434	1.52	43	1.58	48	1.53	44
10	2.64	346	1.97	106	1.57	47	1.52	43
11	2.51	287	1.85	84	1.56	46	1.52	43
12	2.44	255	1.83	81	1.55	46	1.53	44
13	2.37	226	1.80	76	1.56	46	1.54	45
14	2.32	206	1.75	69	1.54	45	1.53	44
15	2.23	174	1.72	65	1.53	44	1.54	45
16	2.18	158	1.69	61	1.53	44	1.54	45
17	2.13	144	1.75	69	1.54	45	1.55	46
18	2.02	117	1.70	62	1.54	45	1.55	46
19	2.03	119	1.68	60	1.55	46	1.58	48
20	2.03	119	1.63	54	1.53	44	1.54	45
21	2.03	119	1.65	56	1.51	42	1.54	45
22	1.92	96	1.65	56	1.51	42	1.54	45
23	1.84	82	1.63	54	1.50	41	1.54	45
24	1.84	82	1.63	54	1.50	41	1.55	46
25	1.83	81	1.61	51	1.50	41	1.56	46
26	1.83	81	1.60	50	1.48	39	1.55	46
27	1.82	79	1.65	56	1.49	40	1.55	46
28	1.82	79	1.59	49	1.49	40	1.55	46
29	1.70	62	1.57	47	1.49	40	1.55	46
30	1.61	51	1.56	46	1.49	40	1.55	46
31	1.52	43	1.55	46	.....	.....	1.55	46

MONTHLY DISCHARGE of Mill creek near Mountain Mill, for 1916

(Drainage area 64 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (22-31)	102	72	82	1.280	0.48	1,626
April	180	73	109	1.700	1.90	6,486
May	503	150	254	3.970	4.58	15,618
June	678	397	547	8.550	9.54	32,549
July	622	43	243	3.800	4.38	14,941
August	106	34	55	0.859	0.99	3,382
September	57	39	46	0.719	0.80	2,737
October	48	39	44	0.688	0.79	2,705
The period	.....	.....	.....	.....	23.46	80,044

MEAN MONTHLY DISCHARGE in Second-feet of Mill creek near Mountain Mill

MONTH	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	98	99	42	72	162	108	44	89	5,491
November	.....	.....	195*b*	52*g*	.....	121*d*	.....	.....	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
March	.....	.....	.....	.....	.....	.....	82*f*	.....	.....	.....
April	.....	106	68	.....	132*c*	149*e*	109	.....	94	5,627
May	.....	322	209	288	226	478	254	.....	296	18,216
June	.....	470	130	311	208	428	547	.....	349	20,769
July	39.0*a*	112	152	100	87	200	243	.....	149	9,156
August	16.9	206	49	66	61	122	55	.....	82	5,058
September	109.0	427	31	36	48	96	46	.....	113	6,749
Total in acre-ft.	9,456	105,130	50,754	52,836	47,338	95,188	83,980	.....	.....	71,066

a 7-31.
b 1-15.
c 13-30.
d 1-3.
e 18-30.
f 22-31.
g 1-15.

CASTLE RIVER NEAR COWLEY

Location.—On the SW. ¼ Sec. 2, Tp. 7, Rge. 1, W. 5th Mer., at G. W. Buchanan's ranch.
Records available.—August 5, 1909, to December 31, 1916; discharge measurement only in 1908.
Gauge.—Open chain; elevation of zero maintained at 92.34 feet since establishment.
Bench-marks.—Permanent iron bench-mark; assumed elevation 100.00.
Channel.—Coarse gravel and not liable to shift.
Discharge measurements.—Made from the bridge at all stages, during open water.
Observer.—G. W. Buchanan.

DISCHARGE MEASUREMENTS of Castle river near Cowley, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 14	W. R. McCaffrey	90	101.0	1.20	3.93*b*	122
Jan. 28	H. W. Rowley	55	69.3	1.70	3.85*b*	118
Feb. 11	do	62	60.8	1.66	3.53*b*	101
Feb. 23	J. E. Caughey	80	98.8	2.88	3.90*b*	285
Mar. 20	J. M. Paul	75	126.0	4.08	2.49	514
April 10	do	107	255.0	3.09	2.81	787
May 10	W. M. Edwards	169	423.0	3.83	3.80	1,617
June 9	do	234	685.0	5.11	5.00	3,498
June 21	W. H. Hannan	268	1,083.0	6.24	6.68	6,762
June 23	do	246	718.0	5.55	5.39	3,984
June 29	do	248	760.0	5.87	5.50	4,427
July 11	W. M. Edwards	227	545.0	4.46	4.32	2,427
Aug. 4	do	108	218.0	2.53	2.56	552
Aug. 31	do	70	110.0	2.92	2.20	320
Oct. 18	E. J. Switzer	63	90.1	2.43	2.02	219
Nov. 24	W. M. Edwards	91	169.0	0.62	2.33*b*	104
Dec. 11	do	80	89.0	1.34	2.69*b*	118
Dec. 28	E. J. Switzer	62	69.9	1.40	2.76*b*	97

b Ice conditions.

DAILY GAUGE HEIGHT AND DISCHARGE of Castle river near Cowley, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.05*b*	150	3.55	115	3.57	208	2.45	480	3.29	1,184	3.95	1,900
2	3.95	135	3.55	113	3.52	204	2.45	480	3.36	1,260	3.85	1,782
3	3.95	120	3.58	112	3.57	202	2.45	480	3.44	1,334	4.35	2,418
4	3.90	118	3.60	110	3.57	202	2.50	515	3.84	1,771	4.35	2,418
5	3.90	122	3.55	109	3.67	201	2.48	501	4.25	2,285	5.05	3,527
6	3.90	133	3.52	108	3.62	201	2.48	501	4.45	2,560	4.85	3,182
7	3.90	135	3.58	106	3.57	203	2.52	529	4.65	2,860	4.65	2,860
8	3.88	135	3.55	104	3.47	206	2.55	551	4.55	2,706	4.55	2,706
9	3.95	131	3.50	103	3.77	209	2.55	551	3.85	1,782	5.03	3,491
10	3.90	123	.....	102	4.05	210	2.80	745	3.83	1,759	5.35	4,073
11	3.85	108	3.55	101	3.92	211	2.85	785	3.55	1,451	4.95	3,350
12	3.88	104	3.55	119	3.67	213	2.90	825	3.45	1,345	4.65	2,860
13	3.90	115	3.60	160	3.50	218	2.91	834	3.30	1,193	4.74	3,004
14	3.91	122	3.78	310	3.12	220	2.91	834	3.20	1,099	4.95	3,350
15	3.90	122	3.88	700	2.87	230	2.96	879	3.15	1,052	5.49	4,333
16	3.95	123	4.38	940	2.80	242	3.00	915	3.15	1,052	6.27	5,907
17	4.00	122	4.38	1,060	2.27	261	3.00	915	3.15	1,052	6.52	6,432
18	3.98	122	4.38	1,100	2.27*b*	315	2.97	888	3.20	1,099	6.52	6,432
19	3.90	129	4.38	950	2.37	425	2.97	888	3.35	1,240	6.82	7,062
20	3.95	132	4.08	440	2.48	501	2.87	801	3.40	1,292	6.44	6,264
21	3.90	135	3.98	330	2.55	551	2.83	769	3.50	1,398	6.71	6,831
22	3.90	134	3.88	300	2.50	515	2.75	705	3.45	1,345	5.86	5,060
23	3.88	132	3.90	285	2.50	515	2.73	689	3.55	1,451	5.43	4,220
24	3.85	130	4.02	270	2.50	515	2.73	689	3.45	1,345	5.06	3,545
25	3.90	126	3.82	251	2.45	480	2.73	689	3.40	1,292	5.10	3,618
26	.....	121	3.82	236	2.45	480	2.93	852	3.35	1,240	5.15	3,709
27	.....	119	3.77	222	2.45	480	3.13	1,033	3.55	1,451	5.20	3,800
28	3.85	118	3.67	215	2.40	445	3.34	1,231	3.85	1,782	5.53	4,410
29	3.75	117	3.65	210	2.35	412	3.24	1,137	3.95	1,900	5.53	4,410
30	3.60	117	.....	.....	2.32	392	3.19	1,090	3.85	1,782	5.18	3,764
31	3.58	116	.....	.....	2.40	445	.....	.....	3.80	1,725	.....	.....

b–*b* Ice conditions.

DAILY GAUGE HEIGHT AND DISCHARGE of Castle river near Cowley, for 1916.—*Concluded.*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.81	3,116	2.65	626	2.21	325	2.02	221	2.01	215	2.39	106
2	5.38	4,128	2.55	551	2.25	349	2.02	221	2.02	221	2.44	109
3	5.26	3,909	2.55	551	2.35	412	2.02	221	2.02	221	2.57	112
4	4.89	3,248	2.56	558	2.60	588	2.02	221	2.05	237	2.54	115
5	4.79	3,084	2.55	551	2.62	603	2.02	221	2.04	232	2.49	117
6	4.49	2,618	2.55	551	2.55	551	2.02	221	2.02	221	2.34	119
7	4.47	2,589	2.45	480	2.47	494	2.02	221	2.01	215	2.29	120
8	4.52	2,661	2.45	480	2.38	432	2.01	215	1.96	192	2.24	120
9	4.51	2,647	3.00	915	2.40	445	2.00	210	1.92*b*	191	2.64	120
10	4.52	2,661	2.80	745	2.36	419	2.00	210	1.93	185	.....	119
11	4.32	2,377	2.75	705	2.33	399	1.98	201	2.50	180	2.69	118
12	4.20	2,220	2.60	588	2.29	373	1.98	201	2.75	174	2.72	118
13	4.15	2,155	2.56	558	2.27	361	1.98	201	3.01	166	2.73	120
14	4.05	2,026	2.55	551	2.25	349	1.98	201	3.02	159	2.76	120
15	3.75	1,669	2.55	551	2.24	343	1.95	187	2.98	150	2.73	119
16	3.65	1,558	2.55	551	2.21	325	1.95	187	2.95	142	2.74	118
17	3.60	1,504	2.65	626	2.20	319	2.00	210	2.86	136	2.73	117
18	3.52	1,419	2.56	588	2.15	291	2.02	221	2.73	131	2.60	116
19	3.38	1,271	2.50	515	2.12	275	2.00	210	2.48	128	2.67	115
20	3.20	1,099	2.46	487	2.05	237	1.98	201	2.53	120	2.74	113
21	3.10	1,005	2.40	445	2.05	237	1.98	201	2.61	114	2.54	111
22	3.15	1,052	2.35	412	2.05	237	1.96	192	2.58	110	2.54	110
23	3.10	1,005	2.30	379	2.05	237	1.94	183	2.33	106	2.79	109
24	2.90	825	2.30	379	2.05	237	1.91	169	2.33	104	2.76	107
25	2.95	870	2.30	379	2.05	237	1.92	174	2.42	104	2.74	102
26	2.92	843	2.30	379	2.05	237	1.95	187	2.48	104	2.74	101
27	2.92	843	2.25	349	2.05	237	2.01	215	2.48	103	2.77	98
28	2.75	705	2.25	349	2.05	237	2.01	215	2.43	103	2.76	97
29	2.75	705	2.25	349	2.02	221	2.01	215	2.42	103	2.75	97
30	2.71	673	2.25	349	2.02	221	2.01	215	2.38	104	2.64	98
31	2.70	665	2.20	319	.....	.....	2.01	215	.....	.....	2.62*b*	98

b–b Ice conditions.

MONTHLY DISCHARGE of Castle river near Cowley, for 1916

(Drainage area 348 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	150	104	125	0.359	0.41	7,686
February	1,100	101	320	0.919	0.99	18,407
March	551	201	326	0.937	1.08	20,045
April	1,231	480	759	2.180	2.43	45,164
May	2,860	1,052	1,551	4.460	5.14	95,345
June	7,062	1,782	4,024	11.560	12.90	239,388
July	4,128	665	1,843	5.300	6.11	113,295
August	915	319	510	1.470	1.70	31,559
September	603	221	341	0.979	1.09	20,291
October	221	174	206	0.592	0.68	12,666
November	237	103	156	0.448	0.50	9,283
December	120	97	112	0.322	0.37	6,887
The year	.....	.....	.....	.....	33.40	619,816

MEAN MONTHLY DISCHARGE in Second-feet of Castle river near Cowley

MONTH	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	204	723	566	304	395	934	528	206	482	29,665
November	.....	.....	.....	867	319	345	605	336	156	438	26,063
December	.....	.....	.....	222	133	138	297	196	112	183	11,252
January	.....	.....	86	107	119	141	221	125	.....	133	8,193
February	.....	.....	118	82	98	164	136	320	.....	153	8,633
March	.....	.....	226	93	88	145	143	326	.....	170	10,464
April	.....	1,116	743	682	612	907	722	759	.....	792	47,098
May	.....	1,908	2,275	1,845	1,954	1,781	2,353	1,551	.....	1,952	120,188
June	.....	1,420	3,675	1,433	2,709	1,545	2,150	4,024	.....	2,422	144,127
July	.....	498	933	1,157	789	596	980	1,843	.....	971	59,689
August	631*a*	204	726	444	426	352	563	510	.....	404	28,331
September	275	371	1,911	290	265	311	419	341	.....	523	31,113
Total in Acre-ft.	50,142	346,006	688,707	472,047	472,288	412,158	577,006	656,490	.....	.....	524,816

a 5-31.

PINCHER CREEK AT PINCHER CREEK

Location.—On the SW. ¼ Sec. 23, Tp. 6, Rge. 30, W. 4th Mer., in the town of Pincher Creek.

Records available.—April 1, 1910, to October 31, 1916. Discharge measurements only; 1906-09.

Gauge.—Vertical staff; elevation of zero maintained at 86.35 feet since establishment.

Bench-mark.—On right concrete abutment of bridge; assumed elevation 100.00 feet.

Channel.—Rock, gravel and gumbo.

Discharge measurements.—Made from bridge and by wading.

Winter flow.—Station not maintained during the winter.

Observer.—Hugh Bertles.

DISCHARGE MEASUREMENTS of Pincher creek at Pincher Creek, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 20	J. M. Paul	46	44.2	1.95	2.91	86.0
April 10	do	48	43.0	1.98	2.96	85.0
May 10	W. M. Edwards	49	43.5	2.02	2.96	88.0
June 19	do	74	76.0	3.55	3.35	270.0
July 11	do	54	52.2	2.35	3.06	123.0
Aug. 4	do	35	19.8	1.30	2.42	26.0
Aug. 31	do	32	16.8	1.20	2.35	20.0
Oct. 13	E. J. Switzer	36	17.6	1.12	2.37	19.7
Nov. 24	W. M. Edwards	26	9.0	0.70	2.60	6.4

DAILY GAUGE HEIGHT AND DISCHARGE of Pincher creek at Pincher Creek, for 1916

Day	February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			3.90	556	3.02	105	3.10	124	3.30	196
2			3.95	600	2.94	88	3.07	117	3.28	188
3			4.00	644	2.85	73	3.05	112	3.26	181
4			4.00	644	2.85	73	3.05	112	3.30	196
5			4.00	644	2.75	59	3.03	107	3.65	378
6			3.90	556	2.85	73	3.07	117	3.44	261
7			3.78	456	2.87	76	3.15	141	3.35	218
8			4.00	644	2.88	77	3.05	112	3.34	214
9			4.00	644	2.98	96	3.03	107	3.37	227
10				573	2.95	90	2.95	90	3.35	218
11				502	2.95	90	2.95	90	3.34	214
12				431	2.95	90	2.94	88	3.24	173
13				360	2.87	76	2.95	90	3.26	181
14				289	2.92	84	2.93	86	3.35	218
15				218	2.97	94	2.93	86	3.37	227
16	5.15	2,023		147	2.92	84	2.94	88	3.34	214
17	4.70	1,444	2.85	73	2.87	76	2.93	86	3.35	218
18	4.40	1,076	2.80	66	2.85	73	2.90	80	3.35	218
19	4.25	904	2.97	94	2.85	73	2.94	88	3.44	261
20	4.18	827	3.70	408	2.83	70	2.94	88	3.55	320
21	4.10	744	2.92	84	2.83	70	2.92	84	3.44	261
22	3.90	556	2.83	70	2.83	70	2.94	88	3.35	218
23	3.88	538	2.85	73	2.82	69	2.94	88	3.23	169
24	3.88	538	2.90	80	2.82	69	3.05	112	3.20	158
25	3.75	438	2.80	66	2.80	66	3.23	169	3.16	144
26	3.72	420	2.73	56	2.78	63	3.23	169	3.24	173
27	3.88	538	2.70	52	2.85	73	3.20	158	3.22	166
28	3.75	438	2.75	59	2.87	76	3.45	266	3.40	240
29	3.95	600	2.64	45	3.02	105	3.43	256	3.53	309
30			2.85	73	3.05	112	3.38	231	3.33	209
31			2.74	58			3.33	209		

DAILY GAUGE HEIGHT AND DISCHARGE of Pincher creek at Pincher Creek, for 1916—*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.23	169	2.45	28.0	2.37	22.0	2.30	16.0
2	3.68	396	2.43	26.0	2.36	21.0	2.32	17.6
3	3.45	266	2.41	25.0	2.43	26.0	2.37	2.20
4	3.35	218	2.42	26.0	2.65	46.0	2.38	22.0
5	3.23	169	2.43	26.0	2.63	44.0	2.40	24.0
6	3.15	141	2.41	25.0	2.54	35.0	2.43	26.0
7	3.15	141	2.39	23.0	2.53	34.0	2.43	26.0
8	3.13	134	2.37	22.0	2.50	32.0	2.40	24.0
9	3.11	127	2.98	96.0	2.45	28.0	2.40	24.0
10	3.07	117	2.82	69.0	2.41	25.0	2.43	26.0
11	3.01	102	2.68	50.0	2.42	26.0	2.42	26.0
12	2.97	94	2.62	42.0	2.44	27.0	2.42	26.0
13	2.97	94	2.60	40.0	2.43	26.0	2.41	25.0
14	2.91	82	2.62	42.0	2.42	26.0	2.41	25.0
15	2.85	73	2.55	36.0	2.40	24.0	2.38	22.0
16	2.83	70	2.45	28.0	2.40	24.0	2.38	22.0
17	2.81	67	2.50	32.0	2.36	21.0	2.42	26.0
18	2.80	66	2.61	41.0	2.35	20.0	2.42	26.0
19	2.74	58	2.54	35.0	2.34	19.2	2.40	24.0
20	2.73	56	2.52	34.0	2.33	18.4	2.40	24.0
21	2.68	50	2.46	29.0	2.31	16.8	2.45	28.0
22	2.65	46	2.45	28.0	2.30	16.0	2.44	27.0
23	2.65	46	2.44	27.0	2.30	16.0	2.45	28.0
24	2.61	41	2.42	26.0	2.30	16.0	2.45	28.0
25	2.60	40	2.40	24.0	2.30	16.0	2.45	28.0
26	2.63	44	2.42	26.0	2.29	15.4	2.45	28.0
27	2.60	40	2.43	26.0	2.30	16.0	2.52	34.0
28	2.56	37	2.37	22.0	2.30	16.0	2.54	35.0
29	2.51	33	2.34	19.2	2.28	14.8	2.45	28.0
30	2.50	32	2.31	16.8	2.27	14.2	2.44	27.0
31	2.48	30	2.35	20.0			2.43	26.0

MONTHLY DISCHARGE of Pincher Creek at Pincher creek, for 1916

(Drainage area 50 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
February (16-29)	2,023	420.0	792	15.800	8.22	21,987
March	644	45.0	299	5.980	6.89	18,385
April	112	59.0	80	1.600	1.78	4,760
May	266	80.0	124	2.480	2.86	7,624
June	378	144.0	219	4.380	4.89	13,031
July	396	30.0	99	1.980	2.28	6,087
August	96	16.8	33	0.660	0.76	2,029
September	46	14.2	23	0.460	0.51	1,368
October	35	16.0	26	0.520	0.60	1,599
The period					28.79	76,870

MEAN MONTHLY DISCHARGE in Second-feet of Pincher creek at Pincher Creek

MONTH	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	53	92.0	21.0	27.0	73	69	26	52	3,175
November	.....	.....	34.0*b*	24.0*d*	.....	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	.....	792*h*	.....	.....	.....
March	.....	40*a*	103.0*c*	.....	17.2*f*	52*g*	299	.....	299	18,385
April	22.00	42	67.0	146.0*e*	58.0	55	80	.....	54	3,206
May	61.00	219	68.0	141.0	100.0	231	124	.....	135	8,290
June	46.00	209	59.0	128.0	69.0	341	219	.....	153	9,106
July	82.00	51	70.0	44.0	28.0	168	99	.....	77	4,116
August	1.92	66	18.2	28.0	21.0	94	33	.....	37	2,297
September	40.00	308	10.9	13.4	18.0	58	23	.....	67	4,006
Total in acre-feet	10,843	58,088	26,053	30,774	20,157	64,087	79,514	.....	.....	52,581

a 19-31
b 1-15.
c 24-31.
d 1-15.
e 6-30.
f 12-31.
g 10-31.
h 16-29.

OLDMAN RIVER NEAR MACLEOD

Location.—On the NW. ¼ Sec. 10, Tp. 9, Rge. 26, W. 4th Mer., at the traffic bridge.

Records available.—July 10, 1910, to December 31, 1916.

Gauge.—Vertical staff. Zero of gauge maintained at 91.47 feet during 1913. Zero of gauge maintained at 87.67 feet during 1910, 1911, 1912, 1914, 1915 and 1916.

Steven's continuous water stage recorder, type A, was installed at this station during 1916, and set to same datum as the staff-gauge.

Bench-mark.—Permanent bench-mark established on concrete pier; assumed elevation 100.00 feet.

Channel.—Shifts slightly.

Discharge measurements.—Made with current-meter from traffic bridge.

Winter flow.—Records are obtained during the winter season 600 feet below the bridge.

Observer.—Mrs. W. A. Jackson.

DISCHARGE MEASUREMENTS of Oldman river, near Macleod, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 5	W. R. McCaffrey	100	294	1.34	5.80*b*	394
Jan. 18	do	95	285	1.04	4.96*b*	298
Feb. 1	H. W. Rowley	100	237	1.53	4.85*b*	364
Feb. 16	do	.....	.....	.....	6.77	.....*g*
Feb. 22	do	103	362	3.54	3.86	1,282
Mar. 1	do	94	224	1.53	2.38	343
Mar. 4	do	110	448	1.07	5.12*b*	479
Mar. 18	J. M. Paul	102	340	3.29	3.63	1,129
Mar. 29	do	103	342	3.13	3.53	1,081
April 21	do	109	404	4.21	4.15	1,700
April 29	W. M. Edwards	118	567	5.35	5.25	3,036
May 19	do	135	607	4.24	5.15	2,576
June 1	do	327	1,062	4.34	6.20	4,609
June 22	do	549	2,399	6.66	8.90	15,972
June 23	do	437	1,936	6.18	8.10	11,985
June 24	do	414	1,773	6.29	7.70	11,151
June 26	do	408	1,658	5.90	7.53	9,778
June 28	do	419	1,867	7.07	8.15	13,195
June 30	do	427	1,979	6.70	8.13	13,262
July 13	do	359	1,159	4.42	6.30	5,102
Aug. 10	do	126	578	3.62	4.66	2,092
Sept. 8	do	121	467	2.66	3.86	1,243
Oct. 11	E. J. Switzer	109	361	1.74	3.04	629
Oct. 30	W. M. Edwards	109	363	1.64	3.02	595
Nov. 29	do	106	306	1.28	2.78	391
Dec. 13	do	85	248	1.08	3.48*b*	336
Dec. 30	E. J. Switzer	105	268	1.09	3.48*b*	292

b Ice conditions.
g Ice going out; impossible to measure.

Daily Gauge Height and Discharge of Oldman River near Macleod, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	5.70*b*	400	4.85	364	2.50	400	3.60	1,095	5.10	2,620	6.30	4,865
2	5.60	397	4.85	367	4.85	1,200	3.75	1,200	5.15	2,690	6.30	4,865
3	5.70	392	4.85	372	5.10	1,600	3.60	1,095	5.30	2,900	6.20	4,610
4	5.80	390	4.85	380	4.90	1,800	3.50	1,025	6.00	4,140	6.40	5,135
5	5.90	394	4.85	390	5.10	1,800	3.50	1,025	6.30	4,865	7.50	9,510
6	5.90	410	4.85	400	5.10	1,600	3.45	990	6.60	5,730	7.40	9,025
7	5.80	445	4.85	417	4.90	1,400	3.60	1,095	7.20	8,080	7.20	8,080
8	5.80	441	4.85	431	4.70	1,200	3.80	1,240	6.70	6,065	7.15	7,860
9	5.75	402	4.85	452	3.90	1,000	4.10	1,500	6.30	4,865	7.50	9,510
10	5.70	340	4.82	475	5.10	2,000	4.20	1,600	5.80	3,740	7.80	11,030
11	5.70	285	4.80	498	5.00	1,800	4.30	1,700	5.50	3,210	7.50	9,510
12	5.60	276	4.75	560	5.20	1,600	4.30	1,700	5.30	2,900	7.30	8,545
13	5.40	275	4.70	700	4.70	1,500	4.20	1,600	5.20	2,760	7.10	7,645
14	5.25	276	4.60	900	4.10	1,200	4.15	1,550	5.15	2,690	7.50	9,510
15	5.10	280	4.90*b*	1,600	3.80	1,200	4.50	1,900	5.80	3,740	8.40	14,200
16	5.00	288	9.88*g*	8,000*e*	3.70	1,000	4.60	2,000	5.00	2,480	8.90	17,040
17	5.00	295	.....	7,000*e*	3.60	900	4.40	1,800	4.95	2,415	9.00	17,640
18	4.96	298	4.91	2,363	3.63	860	4.30	1,700	4.90	2,350	9.00	17,640
19	4.90	300	4.76	2,182	3.63	860	4.20	1,600	5.05	2,550	9.17	18,682
20	4.80	300	4.21	1,610	3.70	860	4.20	1,600	5.30	2,900	9.57	21,134
21	4.70	305	3.95	1,365	4.05	900	4.15	1,550	5.50	3,210	9.63	21,502
22	4.75	306	3.80	1,240	3.92	920	4.15	1,550	5.50	3,210	9.15	18,560
23	4.80	311	3.58	1,081	3.75	900	4.15	1,550	5.50	3,210	8.00	12,060
24	4.80	318	3.30	885	3.65	1,000	4.15	1,550	5.50	3,210	7.70	10,520
25	4.80	322	3.50	1,025	3.50*g*	900	4.10	1,500	5.50	3,210	7.50	9,510
26	4.80	330	3.35	920	3.40	955	4.10	1,500	5.45	3,130	7.35	8,805
27	4.80	335	3.10	745	3.45	990	4.10	1,500	5.43	3,098	7.60	10,010
28	4.80	339	2.80	560	3.45	990	5.30	2,900	5.60	3,380	8.10	12,590
29	4.80	345	3.12	759	3.53	1,046	5.20	2,760	6.20	4,610	8.30	13,660
30	4.80	352	.....	.....	3.40	955	5.00	2,480	6.40	5,135	8.00	12,060
31	4.85	360	.....	.....	3.40	955	.....	.....	6.40	5,135	.....	.....

b-*b* Ice conditions.
e Discharge estimated.
g-*g* Ice going out and on banks.

PLATE 7

View showing the ice deposited on the right bank of Oldman river above the Canadian Pacific Railway bridge near Macleod during the break-up in February, 1916.
Taken on February 18, 1916, by J. E. Caughey.

PLATE 8

Another view showing the ice deposited on the right bank of Oldman river above the Canadian Pacific Railway bridge near Macleod, during the break-up in February, 1916.
Taken on February 18, 1916, by J. E. Caughey.

DAILY GAUGE HEIGHT AND DISCHARGE of Oldman River near Macleod, for 1916 —*Concluded*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	7.50	9,510	4.20	1,840	3.30	1,300	3.12	1,231	3.00	1,190	2.75	365
2	8.00	12,060	4.10	1,765	3.30	1,300	3.15	1,242	3.00	1,190	2.80	355
3	8.40	14,200	4.00	1,695	3.50	1,400	3.15	1,242	2.95	1,174	3.00	347
4	8.20	13,120	4.00	1,695	3.80	1,565	3.12	1,231	2.90	1,158	2.80	342
5	7.50	9,510	4.00	1,695	4.20	1,840	3.10	1,224	2.90	1,158	2.80	340
6	7.20	8,140	3.90	1,625	4.10	1,765	3.10	1,224	2.90	1,158	2.75	340
7	7.00	7,320	3.82	1,577	4.00	1,695	3.10	1,224	2.95	1,174	2.60	340
8	6.95	7,130	3.80	1,565	3.86	1,601	3.10	1,224	2.97	1,180	2.25	340
9	6.90	6,945	4.30	1,920	3.70	1,505	3.10	1,224	3.00	1,190	2.80	339
10	6.83	6,695	4.66	2,261	3.65	1,475	3.05	1,206	3.10	1,224	2.95	338
11	6.65	6,110	4.30	1,920	3.55	1,425	3.00	1,190	3.00	1,190	3.10	338
12	6.40	5,385	4.00	1,695	3.50	1,400	3.00	1,190	2.30*b*	600	3.20	337
13	6.30	5,125	4.00	1,695	3.50	1,400	3.00	1,190	2.50	600	3.48	336
14	6.18	4,822	3.90	1,625	3.50	1,400	3.00	1,190	2.30	630	3.49	333
15	5.85	4,075	3.72	1,517	3.45	1,375	3.00	1,190	2.30	660	3.52	330
16	5.70	3,780	3.70	1,505	3.40	1,350	3.00	1,190	2.30	678	3.65	328
17	5.56	3,523	3.70	1,505	3.35	1,325	3.00	1,190	3.30	682	3.62	325
18	5.40	3,255	3.80	1,565	3.29	1,296	3.02	1,196	3.30	679	3.61	322
19	5.35	3,175	4.00	1,695	3.25	1,280	3.05	1,206	3.20	664	3.59	320
20	5.30	3,100	3.80	1,565	3.20	1,260	3.07	1,213	3.15	643	3.54	320
21	5.30	3,100	3.72	1,517	3.15	1,242	3.10	1,224	3.10	620	3.48	318
22	5.15	2,875	3.65	1,475	3.10	1,224	3.05	1,206	3.10	590	3.44	315
23	4.90	2,545	3.60	1,450	3.00	1,190	3.00	1,190	2.95	555	3.40	310
24	4.62	2,220	3.60	1,450	3.00	1,190	3.00	1,190	2.80	512	3.40	309
25	4.60	2,200	3.57	1,435	3.00	1,190	3.00	1,190	2.80	478	3.40	305
26	4.60	2,200	3.54	1,420	3.00	1,190	3.00	1,190	2.80	450	3.40	302
27	4.50	2,100	3.52	1,410	3.05	1,206	3.05	1,206	2.75	420	3.35	300
28	4.45	2,055	3.50	1,400	3.10	1,224	3.10	1,224	2.70	402	3.30	300
29	4.40	2,010	3.45	1,375	3.10	1,224	3.10	1,224	2.78	391	3.40	295
30	4.30	1,920	3.42	1,360	3.10	1,224	3.05	1,206	2.75	378	3.48	294
31	4.25	1,880	3.30	1,300	.....	.....	3.00	1,190	.....	.....	3.48*b*	292

b-b Ice conditions.

MONTHLY DISCHARGE of Oldman river near Macleod, for 1916

(Drainage area 2,255 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	445	275	339	0.150	0.17	20,844
February	8,000	364	1,312	0.582	0.63	75,466
March	2,000	400	1,171	0.519	0.60	72,002
April	2,900	990	1,595	0.707	0.79	94,909
May	8,080	2,350	3,685	1.630	1.88	226,581
June	21,502	4,610	11,510	5.100	5.69	684,892
July	14,200	1,880	5,229	2.320	2.68	321,519
August	2,261	1,300	1,597	0.708	0.82	98,195
September	1,840	1,190	1,369	0.607	0.68	81,461
October	1,242	1,190	1,208	0.536	0.62	74,277
November	1,224	378	787	0.349	0.39	46,830
December	365	292	325	0.144	0.17	19,983
The year	.....	.....	.....	.....	15.12	1,816,959

MEAN MONTHLY DISCHARGE in Second-feet, of Oldman river near Macleod

MONTH	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	1,057	1,287	696	774	1,670	1,122	1,208	1,116	60,062
November	.....	.....	1,372	713	667	1,277	891	787	951	56,599
December	.....	.....	644	425	412	506	547	325	476	29,266
January	.....	.....	396	306	283	427	339	.....	350	21,533
February	.....	.....	319	284	235	342	1,312	.....	498	29,017
March	.....	1,051	845	384	401	468	1,171	.....	720	36,975
April	.....	1,779	1,636	2,610	1,573	1,713	1,595	.....	1,818	108,159
May	.....	5,921	3,148	5,220	4,102	6,538	3,685	.....	4,769	299,385
June	.....	8,357	3,815	6,151	3,655	6,155	11,510	.....	6,607	395,144
July	756*a*	1,971	2,999	1,811	1,511	3,311	5,229	.....	2,805	172,493
August	461	2,080	1,214	1,158	768	1,645	1,597	.....	1,275	78,366
September	624	4,060	732	765	674	948	1,369	.....	1,310	79,234
Total in acre-ft.	95,436	1,543,688	1,095,694	1,239,740	911,003	1,527,342	1,831,510	.....	.....	1,366,233

a 12-31.

CARMICHAEL DITCH NEAR STAVELY

Location.—On the SE. ¼ Sec. 34, Tp. 13, Rge. 29, W. 4th Mer.
Records available.—Partial records for 1912 and 1913.
Gauge.—Vertical staff.
Bench-mark.—On post, at elevation of 4.51 feet above zero of gauge.
Discharge measurements.—Made by weir.
Observer.—J. Carmichael.
Remarks.—No records were received for 1916, but the inspecting engineer reports that a little water was used during June and part of July.

TROUT CREEK AT LOCKWOOD'S RANCH

Location.—On SE. ¼ Sec. 32, Tp. 11, Rge. 28, W. 4th Mer.
Records available.—July 7, 1911, to October 31, 1916.
Gauge.—Vertical staff; elevation 90.30 during 1911; elevation 92.19 during 1912-16.
Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.
Channel.—Composed of gravel.
Discharge measurements.—Made with current-meter by wading.
Winter flow.—Station not maintained during winter.
Observer.—Mrs. G. P. Stewart.

DISCHARGE MEASUREMENTS of Trout creek at Lockwood's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 30	J. M. Paul	15	9.60	1.15	6.44	11
May 1	W. M. Edwards	29	25.80	2.26	3.30	58
May 22	do	28	27.20	1.97	3.40	54
June 19	do	34	58.90	3.67	4.32	216
July 21	do	29	33.60	2.58	3.54	87
Aug. 18	do	24	45.90	1.63	3.37	75
Sept. 18	do	30	26.80	2.13	3.19	57
Oct. 28	do	28	22.40	2.01	3.19	45

DAILY GAUGE HEIGHT AND DISCHARGE of Trout creek at Lockwood's ranch, for 1916

Day	May		June		July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.29	59	4.85	369	3.90	134	3.27	57	3.05	37	3.14	45
2	3.30	60	4.92	393	4.18	186	.....	56*e*	3.05	37	3.16	46
3	3.30	60	5.10	456	4.07	164	3.25	55	3.60	91	3.16	46
4	3.34	64	5.42	576	3.98	147	3.24	54	4.02	154	3.14	45
5	3.36	66	5.82	738	3.98	147	3.27	57	3.58	89	3.25	55
6	3.40	70	5.60	648	3.95	142	3.22	52	3.42	72	3.20	50
7	3.39	69	5.50	608	3.94	140	3.20	50	3.36	66	3.16	46
8	3.39	69	5.39	564	4.00	150	3.20	50	3.34	64	3.12	43
9	3.41	71	5.34	545	3.98	147	3.46	76	3.33	63	3.10	41
10	3.40	70	5.26	515	3.92	137	3.37	67	3.31	61	3.10	41
11	3.40	70	5.04	434	3.93	139	3.28	58	3.30	60	3.09	40
12	3.42	72	4.92	393	3.86	128	3.25	55	3.27	57	3.09	40
13	3.41	71	4.80	352	3.80	118	3.21	51	3.28	58	3.09	40
14	3.40	70	4.70	320	3.70	104	3.19	49	3.26	56	3.09	40
15	3.38	68	4.54	273	3.69	103	3.15	46	3.25	55	3.09	40
16	3.35	65	4.41	239	3.68	101	3.15	46	3.24	54	3.09	40
17	3.40	70	4.34	222	3.64	96	3.15	46	3.23	53	3.09	40
18	3.36	66	4.36	226	3.68	101	3.37	67	3.19	49	3.12	43
19	3.36	66	4.30	212	3.60	91	3.24	54	3.18	48	3.14	45
20	3.33	63	4.48	257	3.57	88	3.18	48	3.18	48	3.14	45
21	3.33	63	4.26	203	3.54	84	3.17	47	3.16	46	3.13	44
22	3.40	70	4.16	182	3.53	83	3.14	45	3.15	46	3.13	44
23	3.52	82	4.12	174	3.51	81	3.13	44	3.15	46	3.14	45
24	3.58	89	4.10	170	3.50	80	3.10	41	3.15	46	3.15	46
25	3.62	94	4.06	162	3.52	82	3.14	45	3.14	45	3.15	46
26	3.60	91	4.05	160	3.54	84	3.12	43	3.14	45	3.15	46
27	3.57	88	4.04	158	3.50	80	3.10	41	3.14	45	3.15	46
28	3.72	107	4.18	186	.....	76*e*	3.08	39	3.14	45	3.15	46
29	4.06	162	4.06	162	3.42	72	3.06	38	3.13	44	.....	38*e*
30	4.79	349	3.98	147	3.32	62	3.05	37	3.12	43	2.98	31
31	4.72	326	.....	.....	3.32	62	3.05	37	.....	.....	3.00	33

No records prior to May in 1916.
e Discharge estimated.

MONTHLY DISCHARGE of Trout creek at Lockwood's ranch, for 1916

(Drainage area 164 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
May	349	59	92	0.561	0.65	5,657
June	738	147	335	2.040	2.28	19,934
July	186	62	110	0.671	0.77	6,764
August	76	37	50	0.304	0.35	3,074
September	154	37	57	0.347	0.39	3,392
October	55	31	43	0.262	0.30	2,644
The period	.....	.....	.....	.....	4.74	41,465

MEAN MONTHLY DISCHARGE in Second-feet of Trout creek at Lockwood's ranch

MONTH	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	15.0	1.24*h*	54	23.0	17.3	10.7	32	43	28.0	1,710
November	.....	.....	.....	.....	22.0*j*	.....	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
March	.....	.....	13.6	.....	.....	.....	.....	.....	.....	13.6	135
April	.....	8.20*b*	12.5	43*i*	78.0*k*	34.0	26.0	.....	.....	24.0	1,432
May	196.0*a*	6.20*c*	26.0	61	97.0	19.3	206.0	92	.....	84.0	5,136
June	137.0	1.07*d*	36.0	71	82.0	16.9	312.0	335	.....	141.0	8,422
July	63.0	0.20*e*	19.4	69	82.0	16.1	250.0	110	.....	87.0	5,360
August	29.0	0.20*f*	72.0	44	35.0	10.2	97.0	50	.....	48 0	2,972
September	15.0	2.80*g*	111.0	26	10.2	5.8	45.0	57	.....	39.0	2,359
Total in Acre-ft.	21,749	1,371	16,884	21,415	24,005	7,226	57,449	40,789	.....	.....	27,526

a 14-31.
b 8 days.
c 13 days.
d 19 days.
e 12 days.
f 12 days.
g 19 days.
h 11 days.
i 12-30.
j 1-15.
k 13-30.

Records.—May, 1908, to October, 1911, at Stevenson's ranch, SE. 12-12-28-4. April, 1912, to October, 1914, at Lockwood's ranch, SE. 32-11-28-4.

MUDDYPOUND CREEK AT HART'S RANCH

Location.—On the SW ¼ Sec. 27, Tp. 11, Rge. 28, W. 4th Mer., at the foot-bridge on L. O. Hart's ranch.

Records available.—July 27, 1908, to November 22, 1916.

Gauge.—Vertical staff.

Zero maintained at elevation of 91.06 feet during 1908-1911.

Zero maintained at elevation of 90.06 feet during 1912-1916.

Bench-mark.—Permanent iron bench-mark, thirty-five feet northeast of gauge; assumed elevation 100.00 feet.

Channel.—Not liable to shift.

Discharge measurements.—Made by current-meter from bridge at high water, and by wading at low water.

Observer.—Mrs. M. E. Hart.

DISCHARGE MEASUREMENTS of Muddypound creek at Hart's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 30	J. M. Paul	6	2.40	1.29	2.10	3.1
May 1	W. M. Edwards	8	5.30	1.75	2.30	9.3
May 22	do	8	4.10	1.72	2.24	7.1
June 19	do	10	7.00	3.50	2.78	24.5
July 21	do	8	6.10	2.04	2.41	12.5
Aug. 18	do	8	6.15	2.03	2.33	12.5
Sept. 18	do	7	3.40	1.69	2.20	5.8
Oct. 28	do	10	3.90	1.65	2.19	6.4

DAILY GAUGE HEIGHT AND DISCHARGE of Muddypound creek at Hart's ranch, for 1916

Day	February		March*		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			5.10	40.0*e*	2.38	11.6	2.28	8.5	3.10	35.0
2			5.10	40.0*e*	2.30	9.1	2.24	7.3	3.05	34.0
3			5.10	40.0*e*	2.30	9.1	2.20	6.1	3.05	34.0
4			5.10	40.0*e*	2.30	9.1	2.20	6.1	3.05	34.0
5			5.00	40.0*e*	2.30	9.1	2.20	6.1	3.10	35.0
6			5.00	40.0*e*	2.30	9.1	2.20	6.1	3.10	35.0
7			5.00	40.0*e*	2.30	9.1	2.20	6.1	3.10	35.0
8			5.00	40.0*e*	2.34	10.3	2.20	6.1	3.10	35.0
9			5.28	42.0*e*	2.28	8.5	2.20	6.1	3.10	35.0
10			5.98	48.0*e*	2.27	8.2	2.20	6.1	3.08	35.0
11			5.58	45.0*e*	2.25	7.6	2.20	6.1	3.07	34.0
12			4.73	40.0*e*	2.24	7.3	2.20	6.1	3.06	34.0
13			4.53	39.0*e*	2.23	7.0	2.20	6.1	3.02	33.0
14			4.23	38.0*e*	2.22	6.7	2.20	6.1	2.88	28.0
15			3.98	35.0*e*	2.25	7.6	2.20	6.1	2.80	25.0
16			3.98	35.0*e*	2.24	7.3	2.20	6.1	2.80	25.0
17			3.98	35.0*e*	2.21	6.4	2.20	6.1	2.80	25.0
18			3.18	32.0*e*	2.20	6.1	2.20	6.1	2.80	25.0
19			3.08	30.0*e*	2.20	6.1	2.20	6.1	2.80	25.0
20			2.38*b*	8.0*e*	2.20	6.1	2.20	6.1	2.80	25.0
21			2.16	4.9	2.20	6.1	2.20	6.1	2.80	25.0
22			2.16	4.9	2.19	5.8	2.21	6.4	2.78	24.0
23	5.19*b*	40*e*	2.16	4.9	2.19	5.8	2.22	6.7	2.74	23.0
24	5.19	40*e*	2.16	4.9	2.19	5.8	2.38	11.6	2.72	22.0
25	5.19	40*e*	2.41	12.5	2.19	5.8	2.45	13.8	2.68	21.0
26	5.17	40*e*	2.26	7.9	2.19	5.8	2.39	11.9	2.64	19.9
27	5.15	40*e*	2.26	7.9	2.19	5.8	2.34	10.3	2.66	21.0
28	5.15	40*e*	2.26	7.9	2.20	6.1	2.77	24.0	2.75	24.0
29	5.15	40*e*	2.26	7.9	2.24	7.3	2.60	18.6	2.66	21.0
30			2.13	4.0	2.26	7.9	3.05	34.0	2.62	19.2
31			2.48	14.8			3.05	34.0		

b–*b* Ice conditions.
e Discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of Muddypound creek at Hart's ranch, for 1916. —*Concluded.*

DAY	July		August		September		October		November	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.60	18.6	2.24	7.30	2.05	1.60	2.21	6.4	2.19	5.80
2	3.19	38.0	2.24	7.30	2.05	1.60	2.22	6.7	2.19	5.80
3	2.72	22.0	2.25	7.60	2.24	7.30	2.23	7.0	2.18	5.50
4	2.62	19.2	2.25	7.60	2.90	29.00	2.24	7.3	2.18	5.50
5	2.59	18.3	2.34	10.30	2.50	15.40	2.25	7.6	2.18	5.50
6	2.54	16.7	2.23	7.00	2.40	12.20	2.25	7.6	2.18	5.50
7	2.50	15.4	2.23	7.00	2.40	12.20	2.25	7.6	2.17	5.20
8	2.50	15.4	2.23	7.00	2.50	15.40	2.25	7.6	2.16	4.90
9	2.50	15.4	3.41	12.50	2.50	15.40	2.25	7.6	2.12	3.70
10	2.46	14.1	2.70	22.00	2.35	10.60	2.25	7.6	2.00	1.00
11	2.46	14.1	2.35	10.60	2.30	9.10	2.25	7.6	2.00	1.00
12	2.46	14.1	2.30	9.10	2.25	7.60	2.24	7.3	2.10	3.10
13	2.50	15.4	2.30	9.10	2.25	7.60	2.24	7.3	2.15	4.60
14	2.42	12.8	2.27	8.20	2.22	6.70	2.23	7.0	2.20	6.10
15	2.42	12.8	2.25	7.60	2.20	6.10	2.22	6.7	2.20	6.10
16	2.42	12.8	2.25	7.60	2.20	6.10	2.21	6.4	2.20	6.10
17	2.52	16.0	2.25	7.60	2.20	6.10	2.22	6.7	2.20	6.10
18	2.72	22.0	2.32	9.70	2.20	6.10	2.24	7.3	2.20	6.10
19	2.45	13.8	2.28	8.50	2.20	6.10	2.28	8.5	2.20	6.10
20	2.40	12.2	2.25	7.60	2.20	6.10	2.25	7.6	2.20	6.10
21	2.40	12.2	2.23	7.00	2.20	6.10	2.24	7.3	2.20	6.10
22	2.40	12.2	2.20	6.10	2.20	6.10	2.23	7.0	2.20	6.10
23	2.35	10.6	2.16	4.90	2.20	6.10	2.24	7.3	.....	.....
24	2.35	10.6	2.12	3.70	2.20	6.10	2.24	7.3	.....	.....
25	2.35	10.6	2.10	3.10	2.20	6.10	2.25	7.6	.....	.....
26	2.42	12.8	2.05	1.60	2.20	6.10	2.25	7.6	.....	.....
27	2.31	9.4	2.00	1.00	2.20	6.10	2.25	7.6	.....	.....
28	2.30	9.1	2.00	1.00	2.20	6.10	2.20	6.1	.....	.....
29	2.30	9.1	2.00	1.00	2.20	6.10	2.20	6.1	.....	.....
30	2.28	8.5	2.00	1.00	2.20	6.10	2.20	6.1	.....	.....
31	2.26	7.9	2.00	1.00	.....	.....	2.19	5.8	.....	.....

MONTHLY DISCHARGE of Muddypound creek at Hart's ranch, for 1916

(Drainage area 44 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
February (23-29)	40.0	40.00	40.0	0.909	0.24	555
March	48.0	4.90	27.0	0.614	0.71	1,660
April	11.6	5.80	7.5	0.170	0.19	446
May	34.0	6.10	9.8	0.223	0.26	603
June	35.0	19.20	28.0	0.636	0.71	1,666
July	38.0	7.90	14.6	0.332	0.38	898
August	22.0	1.00	6.9	0.157	0.18	424
September	29.0	1.60	8.3	0.189	0.21	494
October	8.5	5.80	7.1	0.161	0.19	437
November (1-22)	6.1	1.00	5.1	0.116	0.09	222
The period	.....	.....	.....	.....	3.16	7,405

MEAN MONTHLY DISCHARGE in Second-feet of Muddypound creek at Hart's ranch

MONTH	1907–8	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	6.3	3.70	1.41	10.4	2.90	1.78	4.1	7.6	7.1	5.0	310
November	.....	.....	.....	.....	6.8*d*	4.60	.....	.....	.....	5.1*g*	4.6	147
December	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	.....	.....	.....	40.0*f*	.....	.....	.....
March	.....	.....	.....	8.10*c*	.....	.....	.....	17.2*e*	27.0	.....	27.0	1,660
April	.....	19.2*b*	3.60	3.10	12.8	10.60	6.90	6.5	7.5	.....	7.3	398
May	.....	36.0	2.50	5.30	7.1	6.40	1.75	18.3	9.8	.....	10.9	667
June	.....	30.0	0.55	2.30	7.8	8.70	1.00	35.0	28.0	.....	14.2	841
July	23.0*a*	18.5	Nil	0.79	9.8	4.40	0.05	33.0	14.6	.....	10.1	624
August	14.6	9.7	Nil	8.90	5.4	2.40	0.23	21.0	6.9	.....	7.7	472
September	8.2	4.1	0.30	24.00	4.1	1.25	0.28	9.1	8.3	.....	6.6	397
Total in Acre-ft.	1,621	6,857	647	2,973	3,627	2,109	722	8,253	7,213	.....	.....	5,516

a 27-31.
b 17-30.
c 20-21.
d 1-11.
e 16-31.
f 23-29.
g 1-22.

WILLOW CREEK NEAR MACLEOD

Location.—On the NE. ¼ Sec. 20, Tp. 9, Rge. 26, W. 4th Mer.
Records available.—August 13, 1915, to December 31, 1916.
Gauge.—Vertical staff; zero elevation 89.65.
Bench-mark.—Permanent iron bench-mark set in 1916; assumed elevation 100.00 feet.
Channel.—One channel except at very high stages; clean gravel and sand bottom.
Discharge measurements.—Made from bridge, except at low water.
Observer.—Miss B. Connolly.

DISCHARGE MEASUREMENTS of Willow creek near Macleod, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 4	W. R. McCaffrey	49	99.4	0.33	1.33*b*	32.0
Jan. 17	do	28	28.8	0.25	1.23*b*	7.3
Feb. 1	H. W. Rowley	35	25.0	0.42	1.90*b*	10.4
Feb. 15	do	70	26.0	0.88	2.74*b*	23.0
Feb. 29	do	129	195.0	0.29	2.53*c*	57.0
Mar. 4	do	155	97.0	0.48	2.29*c*	47.0
Mar. 17	J. M. Paul	72	134.0	1.98	1.79	265.0
Mar. 29	do	68	133.0	1.68	1.68	223.0
April 21	do	73	128.0	1.60	1.60	205.0
May 20	W. M. Edwards	75	146.0	1.71	1.71	249.0
June 2	do	132	422.0	4.21	3.44	1,773.0
June 23	do	119	272.0	3.61	2.56	982.0
June 24	do	118	267.0	3.35	2.46	895.0
June 29	do	134	445.0	4.99	3.53	2,224.0
July 14	do	110	212.0	2.41	2.16	511.0
Aug. 11	do	106	190.0	2.11	2.00	412.0
Sept. 9	do	104	182.0	1.80	1.88	327.0
Oct. 11	E. J. Switzer	75	139.0	1.65	1.65	224.0
Oct. 30	W. M. Edwards	73	144.0	1.52	1.59	219.0
Nov. 28	do	140	190.0	0.84	1.75*b*	159.0
Dec. 15	do	54	78.0	1.37	1.80*b*	107.0
Dec. 30	E. J. Switzer	33	64.3	0.86	1.75*b*	55.0

b Ice conditions.
c Gauge height affected by backwater from ice jam.

Daily Gauge Height and Discharge of Willow creek near Macleod, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.33*b*	46.0	1.90	10.4	2.53	55	1.55	184	1.30	92	2.96	1,446
2	1.43	42.0	1.90	10.4	2.45	52	1.70	250	1.30	92	2.98	1,466
3	1.53	37.0	1.90	10.4	2.53	47	1.75	274	1.20	60	2.97	1,453
4	1.33	32.0	1.90	11.0	.....	47	1.75	274	1.25	76	2.96	1,440
5	1.38	35.0	2.00	12.0	2.46	47	1.73	264	1.40	125	3.07	1,585
6	1.63	45.0	2.05	12.0	2.46	49	1.66	232	1.60	205	2.96	1,440
7	1.68	49.0	2.10	13.0	2.46	53	1.65	227	1.55	184	2.91	1,375
8	1.68	45.0	2.00	14.0	1.73	57	1.57	192	1.80	298	2.91	1,375
9	1.53	31.0	2.00	15.0	1.13	64	1.55	184	1.75	274	3.06	1,572
10	Dry	23.0	2.05	17.0	1.13	71	1.55	184	1.75	274	3.41	2,054
11	"	15.0	2.05	18.0	1.13	83	1.50	163	1.65	227	2.96	1,440
12	"	9.0	2.05	19.0	.....	100	1.55	184	1.50	163	2.97	1,453
13	"	5.0	2.10	20.0	.....	122	1.56	188	1.51	167	2.96	1,440
14	"	2.0	2.15*b*	22.0	.....	141	1.57	192	1.50	163	2.91	1,375
15	"	3.0	2.74	23.0	.....	177	1.67	237	1.55	184	2.90	1,362
16	"	5.0	3.31	30.0	.....	215	1.75	274	1.49	159	2.86	1,311
17	1.23	7.3	3.15	280.0	1.80	298	1.75	274	1.49	159	2.91	1,375
18	1.75	8.0	3.18	303.0	1.85	326	1.65	227	1.50	163	2.61	1,004
19	1.80	9.0	0.33	260.0	1.79	293	1.58	197	1.48	155	2.66	1,064
20	1.70	9.0	0.23	190.0	1.85	326	1.55	184	1.71	255	2.74	1,161
21	1.65	10.0	0.23	130.0	1.87	336	1.60	205	1.46	148	2.74	1,161
22	1.65	10.0	Dry	90.0	1.79	293	1.60	205	1.81	304	2.70	1,112
23	1.60	10.0	1.73	77.0	1.65	227	1.70	250	1.96	389	2.59	980
24	1.80	10.0	1.83	71.0	1.65	227	1.80	298	1.96	389	2.36	722
25	2.00	9.0	1.78	68.0	1.55	184	1.79	293	2.06	457	2.31	672
26	2.00	8.0	1.73	65.0	1.50	163	1.72	260	2.16	537	2.40	762
27	2.05	8.0	2.73	62.0	1.45	144	1.63	219	2.16	537	2.46	830
28	2.10	9.0	2.68	60.0	1.55	184	1.50	163	2.16	537	2.55	934
29	2.15	9.0	2.53	57.0	1.68	241	1.50	163	2.16	537	2.51	888
30	2.20	9.0	.....	.....	1.73	264	1.60	205	2.76	1,186	2.76	1,186
31	2.00	10.0	.....	.....	1.65	227	.....	.....	2.96	1,440	.....	.....

b–b Ice conditions.

Monthly Discharge of Willow creek near Macleod, for 1910-11

(Drainage area 1,013 square miles)

Month	Discharge in Second-Feet				Run-off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
1910						
April	45.0	35.00	41.0	0.040	0.04	2,440
May	68.0	35.00	53.0	0.052	0.06	3,259
June	35.0	7.50	23.0	0.023	0.03	1,369
July	7.5	1.10	3.2	0.003	0.00	197
August	4.3	0.90	2.7	0.003	0.00	166
September	82.0	5.20	47.0	0.046	0.05	2,797
October	70.0	24.00	48.0	0.047	0.05	2,951
The period					0.23	13,179
1911						
March (22-31)	292	65	185	0.183	0.07	3,669
April	131	34	77	0.076	0.08	4,582
May	881	64	211	0.208	0.24	12,974
June	460	93	199	0.197	0.22	11,841
July	144	42	72	0.071	0.08	4,427
August	1,312	48	309	0.305	0.35	19,000
September	1,413	113	515	0.508	0.57	30,645
October	253	48	136	0.134	0.15	8,362
November (1-15)	174	81	136	0.134	0.08	4,045
The period					1.84	99,545

Note—These tables are inserted in this report to correct tables which were published on pages 64 of the report for 1910 and 103 of the report for 1911.

DAILY GAUGE HEIGHT AND DISCHARGE of Willow creek near Macleod, for 1916—*Concluded*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.76	1,186	1.60	205	1.40	125	1.59	201	1.66	232	1.79	155
2	2.80	1,235	1.50	163	1.35	108	1.65	227	1.53	176	1.77	154
3	2.81	1,248	1.45	144	1.40	125	1.67	237	1.54	180	1.77	153
4	2.76	1,186	1.43	136	1.30	92	1.68	241	1.65	227	1.79	153
5	2.66	1,064	1.45	144	2.20	570	1.58	197	1.65	227	1.82	152
6	2.56	946	1.40	125	2.10	487	1.70	250	1.67	237	1.80	151
7	2.51	888	1.35	108	2.00	413	1.84	320	1.58	197	1.75	148
8	2.46	830	1.30	92	1.95	383	1.75	274	1.58	197	1.73	144
9	2.55	934	1.90	353	1.90	353	1.69	246	1.69	246	1.73	139
10	2.46	830	2.00	413	1.85	326	1.66	232	1.79*b*	244	1.70	132
11	2.36	722	2.00	413	1.80	298	1.66	232	1.29	236	1.70	125
12	2.26	625	1.90	353	1.76	279	1.68	241	1.69	212	1.70	120
13	2.16	537	1.50	163	1.70	250	1.65	227	1.99	199	1.80	115
14	2.16	537	1.40	125	1.65	227	1.64	223	2.01	201	1.75	110
15	2.00	413	1.35	108	1.65	227	1.63	218	1.29	204	1.80	107
16	1.90	353	1.40	125	1.65	227	1.66	232	2.05	205	1.80	104
17	1.80	298	1.50	163	1.65	227	1.71	255	2.10	203	1.86	100
18	1.90	353	1.59	201	1.53	176	1.74	269	2.10	198	1.86	97
19	1.95	383	1.59	201	1.45	144	1.72	260	2.08	189	1.87	93
20	1.90	353	1.50	163	1.65	227	1.77	284	2.01	184	1.87	90
21	2.00	413	1.50	163	1.60	205	1.76	279	2.02	179	1.88	88
22	1.95	383	1.45	144	1.50	163	1.82	309	2.02	175	2.43	85
23	1.90	353	1.40	125	1.48	155	1.76	279	2.02	172	2.43	81
24	1.80	298	1.45	144	1.45	144	1.73	264	2.01	170	2.44	78
25	1.85	326	1.40	125	1.40	125	1.72	260	2.00	168	2.44	73
26	1.85	326	1.45	144	1.45	144	1.69	246	1.98	166	2.48	69
27	1.80	298	1.52	101	1.50	163	1.74	269	1.90	163	2.65	65
28	1.75	274	1.50	163	1.55	184	1.72	260	1.78	159	2.65	62
29	1.70	250	1.45	144	1.55	184	1.64	223	1.78	156	2.65	58
30	1.65	227	1.40	125	1.57	192	1.59	201	1.74	155	1.95	55
31	1.50	163	1.40	125	.....	.....	1.69	246	.....	.....	1.95*b*	55

b–b Ice conditions.

MONTHLY DISCHARGE of Willow creek near Macleod, for 1916

(Drainage area 1,006 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	49	2.0	18.0	0.018	0.02	1,107
February	303	10.4	68.0	0.068	0.07	3,911
March	336	47.0	165.0	0.164	0.19	10,145
April	298	163.0	222.0	0.221	0.25	13,210
May	1,440	60.0	320.0	0.318	0.36	19,676
June	2,054	672.0	1,248.0	1.240	1.38	74,261
July	1,248	163.0	588.0	0.584	0.67	36,155
August	413	92.0	174.0	0.173	0.20	10,690
September	570	92.0	231.0	0.230	0.26	13,745
October	309	197.0	248.0	0.246	0.28	15,249
November	246	155.0	195.0	0.194	0.22	11,603
December	155	55.0	107.0	0.106	0.12	6,579
The year	.....	.....	.....	.....	4.02	216,331

MEAN MONTHLY DISCHARGE in Second-feet of Willow creek near Macleod

MONTH	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	41.0	48	136	121	85	125	189	248	124	7,632
November	.....	.....	.....	136*f*	115*b*	.....	.....	140	195	168	9,967
December	.....	.....	.....	.....	.....	.....	.....	106	107	106	6,548
January	.....	.....	.....	.....	.....	.....	.....	18	.....	18	1,107
February	.....	.....	.....	.....	.....	.....	.....	68	.....	68	3,911
March	.....	.....	185*h*	.....	.....	65*d*	207*e*	165	.....	165	10,145
April	.....	41.0	77	256*a*	490*c*	182	130	222	.....	130	7,760
May	.....	53.0	211	305	397	156	994	320	.....	348	21,398
June	.....	23.0	199	381	317	151	1,609	1,248	.....	561	33,398
July	295	3.2	72	493	300	91	1,226	588	.....	384	23,585
August	134	2.7	309	285	187	31	543	174	.....	208	12,794
September	44	47.0	515	137	92	22	286	231	.....	172	10,225
Total in acre-ft.	28,998	12,771	90,089	115,440	112,850	45,119	302,180	209,370	.....	.....	148,466

a 20-30.
b 1-15.
c 7-31.
d 19-31.
e 22-31.
f 1-15.
h 22-31.
Records.—July 1909 to Aug. 1915 on SE. 26-9-26-4. Sept. 1915 to Dec. 1916 on NE. 20-9-26-4.

OLDMAN (BELLY) RIVER NEAR LETHBRIDGE

Location.—On the traffic bridge on the NW. ¼ Sec. 1, Tp. 9, Rge. 22, W. 4th Mer.
Records available.—August 31, 1911, to December 31, 1916.
Gauge.—Chain gauge; elevation of zero maintained at 87.82 feet during 1911-12; 85.70 feet during 1913-16.
Bench-mark.—Top of arrow marked with white paint on the right abutment; assumed elevation 100.00 feet.
Discharge measurements.—Made from downstream side of the traffic bridge.
Winter flow.—Obtained through the ice one-half mile below the traffic bridge.
Observer.—Wm. Bedster.

DISCHARGE MEASUREMENTS of Oldman river near Lethbridge, in 1916

DATE	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq.-ft.*	*Ft. per sec*	*Feet*	*Sec.-ft.*
Jan. 7	W. H. Storey	304	1,294	0.61	3.73*b*	790
Feb. 3	V. A. Newhall	159	863	0.81	3.64*b*	698
Feb. 20	H. W. Rowley	421	2,327	3.20	5.73	7,446
Mar. 9	do	301	1,349	1.83	3.14	2,464
Mar. 28	J. M. Paul	353	1,672	1.86	3.66	3,104
April 27	do	372	1,784	1.96	3.99	3,498
May 18	W. M. Edwards	414	2,281	2.49	5.00	5,678
June 16	do	594	4,416	4.89	8.97	21,592
June 21	J. E. Degnan	651	6,271	7.00	11.24	43,895
June 22	do	652	6,459	6.56	11.49	42,398
June 25	do	613	4,823	5.68	8.98	27,381
June 27	do	611	4,615	5.44	8.76	25,129
July 1	do	625	4,752	6.12	9.91	29,063
July 19	W. M. Edwards	500	2,878	3.85	6.72	11,086
Aug. 15	do	391	1,700	2.43	4.20	4,228
Sept. 12	do	371	1,589	2.28	4.00	3,615
Oct. 7	J. R. Estey	344	1,165	1.64	2.90	1,905
Oct. 20	E. J. Switzer	336	1,106	1.64	2.75	1,821
Nov. 13	W. M. Edwards	288	555	0.63	1.13	350
Dec 6	H. W. Rowley	209	862	1.13	2.24	976
Dec 27	do	315	1,038	0.73	3.70*b*	754

b Ice conditions.

DAILY GAUGE HEIGHT AND DISCHARGE of Oldman river near Lethbridge, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.03*b*	960	3.52	695	2.90	1,970	3.72	3,102	5.03	5,672	7.20	12,800
2	3.00	940	3.52	695	2.44	1,460	4.18	3,884	5.15	5,965	7.04	12,160
3	.....	915*e*	3.51	698	1.58	684	4.10	3,740	5.30	6,360	6.92	11,680
4	.....	880*e*	3.50	700	1.89	932	3.98	3,536	5.53	7,008	7.20	12,800
5	.....	845*e*	3.54	705	2.01	1,039	3.85	3,315	5.78	7,720	7.70	14,840
6	3.54	815	3.57	710	2.44	1,460	3.86	3,332	6.22	9,148	8.84	20,736
7	3.88	790	3.58	725	2.90	1,970	3.82	3,264	6.60	10,480	8.71	19,940
8	3.93	760	3.60	740	3.42	2,650	3.80	3,230	6.30	9,420	7.98	16,104
9	3.94	720	3.59	770	3.16	2,298	3.79	3,214	6.28	9,352	8.00	16,200
10	4.02	710	3.62	800	3.80	3,230	3.92	3,434	6.25	9,250	8.20	17,160
11	3.95	715	3.63	850	5.02	5,648	4.15	3,830	6.24	9,216	8.80	20,480
12	3.84	725	3.63	960	6.75	11,020	4.13	3,794	5.98	8,336	8.44	18,408
13	3.70	745	3.90	1,700	6.10	8,740	4.12	3,776	5.72	7,540	8.11	16,728
14	3.64	770	4.18	2,060	5.00	5,600	4.12	3,776	5.50	6,920	8.23	17,316
15	3.66	800	4.76	2,300	4.49	4,451	4.28	4,064	5.37	6,556	8.47	18,564
16	3.69	830	5.58*b*	2,660	4.31	4,118	4.50	4,470	5.22	6,144	8.97	21,596
17	3.62	860	8.79*g*	12,000	4.14	3,812	4.38	4,244	5.08	5,792	9.95	29,320
18	3.54	890	7.85*g*	10,000	3.99	3,553	4.24	3,992	5.14	5,940	10.25	32,060
19	3.52	905	6.60*g*	9,000	3.84	3,298	4.19	3,902	5.17	6,015	10.66	35,936
20	3.54	915	5.73	7,570	3.88	3,366	4.18	3,884	5.20	6,090	11.40	43,040
21	3.53	910	5.11	5,865	4.00	3,570	4.14	3,812	5.50	6,920	11.39	42,944
22	3.50	880	4.68	4,838	4.00	3,570	4.11	3,758	5.52	6,976	11.25	41,600
23	3.53	800	4.50	4,470	4.02	3,604	3.96	3,502	5.60	7,200	10.18	31,416
24	3.58	760	4.38	4,244	3.92	3,434	3.97	3,519	5.78	7,720	9.34	24,240
25	3.53	740	3.71	3,086	3.81	3,247	3.89	3,383	6.32	9,488	8.80	20,480
26	3.49	730	3.44	2,680	3.68	3,040	3.92	3,434	6.71	10,876	8.82	20,608
27	3.44	710	3.37	2,578	3.60	2,920	3.98	3,536	6.60	10,480	8.92	21,256
28	3.39	715	3.37	2,578	3.66	3,010	4.20	3,920	6.60	10,480	9.54	25,840
29	3.45	705	3.35	2,550	3.61	2,935	4.50	4,470	6.73	10,948	10.55	34,880
30	3.54	700	.....	.....	3.59	2,905	4.92	5,408	6.90	11,600	10.40	33,460
31	3.53	700	.....	.....	3.56	2,860	.....	.....	7.10	12,400	.....	.....

b-b Ice conditions.
g Ice going out.
e Discharge estimated from winter hydrograph.

DAILY GAUGE HEIGHT AND DISCHARGE of Oldman river near Lethbridge, for 1916—*Concluded*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	9.83	28,264	4.54	4,550	3.47	2,725	2.72	1,762	2.58	1,608	2.14	1,160
2	9.80	28,000	4.45	4,375	3.43	2,665	2.75	1,795	2.55	1,575	2.17	1,190
3	9.89	28,792	4.33	4,154	3.87	3,349	2.81	1,862	2.52	1,542	2.05	1,075
4	9.62	26,488	4.28	4,064	4.53	4,530	2.95	2,030	2.53	1,553	1.95	985
5	9.59	26,240	4.19	3,902	5.23	6,171	2.98	2,066	2.60	1,630	2.01	1,039
6	8.59	19,224	4.12	3,776	5.04	5,696	2.97	2,054	2.62	1,652	2.24	1,260
7	8.20	17,160	4.01	3,587	4.84	5,216	2.99	2,078	2.60	1,630	2.00	1,030
8	8.01	16,248	3.93	3,451	4.77	5,048	2.91	1,982	2.59	1,619	1.97	1,003
9	7.95	15,960	4.60	4,670	4.66	4,796	2.90	1,970	1.90	940	1.91	949
10	8.00	16,200	4.63	4,733	4.25	4,010	2.83	1,886	1.71	788	1.81	868
11	7.94	15,912	4.62	4,712	4.05	3,655	2.78	1,828	1.68	764	1.73	804
12	7.70	14,840	4.60	4,670	4.00	3,570	2.72	1,762	1.65	740	1.65	740
13	7.55	14,200	4.55	4,570	3.83	3,281	2.71	1,751	1.13	351	1.65	740
14	7.34	13,360	4.28	4,064	3.75	3,150	2.68	1,718	1.40	540	1.64	732
15	7.12	12,480	4.12	3,776	3.69	3,055	2.68	1,718	1.63	724	2.10	1,120
16	6.90	11,600	4.03	3,621	3.60	2,920	2.71	1,751	2.15	1,170	3.55	2,845
17	6.72	10,912	4.02	3,604	3.51	2,785	2.71	1,751	2.29	1,310	3.70	3,070
18	6.95	11,800	4.18	3,884	3.47	2,725	2.72	1,762	2.56	1,586	3.79	3,214
19	6.72	10,912	4.15	3,830	3.32	2,508	2.71	1,751	2.66	1,696	3.88	3,366
20	6.44	9,904	4.16	3,848	3.20	2,350	2.68	1,718	2.70	1,740	3.95	3,485
21	6.20	9,080	4.19	3,902	3.13	2,259	2.65	1,685	2.72	1,762	.....*b*	980*e*
22	5.98	8,336	4.14	3,812	3.09	2,207	2.76	1,806	2.70	1,740	.....	960*e*
23	5.66	7,368	3.97	3,519	3.01	2,103	2.75	1,795	2.63	1,663	3.70	930
24	5.52	6,976	3.90	3,400	2.95	2,030	2.80	1,850	2.56	1,586	3.71	870
25	5.45	6,780	3.87	3,349	2.96	2,042	2.70	1,740	2.53	1,553	3.78	810
26	5.37	6,556	3.82	3,264	3.00	2,090	2.68	1,718	2.46	1,480	3.81	770
27	5.28	6,306	3.78	3,198	2.95	2,030	2.68	1,718	2.40	1,420	3.70	754
28	5.14	5,940	3.74	3,134	2.88	1,946	2.70	1,740	2.36	1,380	.....	740*e*
29	4.93	5,432	3.69	3,055	2.84	1,898	2.71	1,751	2.28	1,300	.....	735*e*
30	4.82	5,168	3.63	2,965	2.77	1,817	2.65	1,685	2.19	1,210	3.63	730
31	4.66	4,796	3.49	2,755	.....	.....	2.63	1,663	.....	.....	3.60*b*	730

b-b Ice conditions.
e Discharge estimated from winter hydrograph.

MONTHLY DISCHARGE of Oldman river near Lethbridge, for 1916

(Drainage area 6,764 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	960	700	801	0.118	0.14	49,240
February	12,000	695	3,077	0.455	0.49	176,949
March	11,020	684	3,432	0.507	0.58	210,975
April	5,408	3,102	3,751	0.554	0.62	223,147
May	12,400	5,672	8,194	1.210	1.40	503,710
June	43,040	11,680	23,486	3.480	3.88	1,397,182
July	28,792	4,796	13,588	2.010	2.32	835,295
August	4,733	2,755	3,813	0.564	0.65	234,397
September	6,171	1,817	3,154	0.466	0.52	187,631
October	2,078	1,663	1,811	0.268	0.31	111,328
November	1,762	351	1,342	0.198	0.22	79,836
December	3,485	730	1,280	0.189	0.22	78,685
The year					11.35	4,088,375

MEAN MONTHLY DISCHARGE in Second-feet of Oldman river near Lethbridge

MONTH	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October		2,836	1,636	2,121	3,999	3,591	1,811	2,666	163,844
November		2,135	a1,856	1,786	2,995	2,095	1,342	2,071	116,429
December		1,672		904	1,094	984	1,240	1,179	59,041
January		964	618	671	916	801		794	48,819
February		896	412	622	722	3,077		1,146	65,202
March		1,806	451	1,122	1,962	3,432		1,755	107,810
April		3,610	5,114	3,412	3,475	3,751		3,872	230,413
May		7,886	9,384	8,606	10,500	8,194		8,914	548,010
June		7,883	15,725	7,928	14,438	23,486		13,892	826,533
July		6,792	6,087	3,799	9,165	13,588		7,886	484,841
August		2,953	3,487	1,923	5,107	3,813		3,457	212,494
September	8,788	1,625	1,952	1,616	3,316	3,154		3,408	202,764
Total in acre-ft.	522,894	2,385,850	2,810,103	2,089,000	3,494,816	4,224,493			3,066,200

a 1-27

MISCELLANEOUS DISCHARGE MEASUREMENTS made in Oldman river drainage basin, in 1916

Date	Engineer	Stream	Location	Width	Area of Section	Mean Velocity	Discharge
				Feet	*Sq. ft.*	*Ft. per sec.*	*Sec.-ft.*
Jan. 27	H. W. Rowley	Bellevue creek	SE. 29-7-3-5				0.68*w*
Feb. 8	do	do	do				0.64*w*
Feb. 25	do	do	do				0.95*w*
Mar. 14	do	do	do				1.25*w*
Mar. 24	J. M. Paul	do	do				1.20*w*
June 5	W. M. Edwards	do	do				1.46*w*
July 3	do	do	do				1.09*w*
Aug. 1	do	do	do				Nil *w*
Aug. 29	do	do	do				0.60*w*
Nov. 17	do	do	do				0.53*w*
Dec. 6	V. A. Newhall	do	do				0.60*w*
Dec. 21	E. J. Switzer	do	do				0.57*w*
Feb. 10	W. H. Rowley	Blairmore creek	SE. 10-8-4-5	7.0	4.30	0.40	1.72
Feb. 24	do	do	do	9.0	6.60	0.76	5.00
Mar. 13	do	do	do	10.0	9.20	1.26	11.60
Mar. 23	J. M. Paul	do	do	15.0	10.30	1.62	16.70
April 14	do	do	do	25.5	21.60	1.97	42.00
June 6	W. M. Edwards	do	do	27.0	25.90	2.82	73.00
July 4	do	do	do	27.0	26.80	2.95	79.00
Aug. 2	do	do	do	21.0	10.20	0.99	10.10
Aug. 30	do	do	do	18.0	8.10	0.77	6.30
Nov. 16	do	do	do	9.0	2.55	0.75	1.92
Dec. 7	do	do	do	8.0	3.70	0.61	2.30
Dec. 22	E. J. Switzer	do	do	8.0	2.55	0.61	1.55
Jan. 12	W. R. McCaffrey	Drum creek	NW. 18-7-3-5	9.0	3.30	0.58	1.90
Feb. 8	H. W. Rowley	do	do	6.5	1.55	0.77	1.19
Feb. 25	do	do	do	9.0	2.60	0.96	2.50
Mar. 14	do	do	do	10.0	3.60	1.44	5.20
Mar. 24	J. M. Paul	do	do	9.5	3.17	1.22	3.90
May 9	W. M. Edwards	do	do	14.0	11.00	1.55	17.10
June 5	do	do	do	15.0	18.10	1.43	26.00
July 3	do	do	do	13.0	9.15	1.58	14.40
Aug. 1	do	do	do	10.5	4.17	1.20	5.00
Aug. 29	do	do	do	11.0	2.70	0.82	2.20
Nov. 17	do	do	do	8.0	2.25	0.72	1.61
Dec. 6	do	do	do	9.0	2.00	0.84	1.67
Dec. 21	E. J. Switzer	do	do	8.0	1.60	0.76	1.21
Jan. 27	H. W. Rowley	Gold creek	NE. 30-7-3-5	22.0	29.00	0.76	22.00
Feb. 25	do	do	do	22.0	15.80	1.06	16.80
Mar. 14	do	do	do	22.0	19.80	1.16	23.00
Mar. 24	J. M. Paul	do	do	22.0	18.50	1.24	23.00
May 9	W. M. Edwards	do	do	23.0	28.80	2.83	81.00
June 5	do	do	do	23.0	30.60	3.28	100.00
July 3	do	do	do	23.5	34.80	4.02	140.00
Aug. 1	do	do	do	22.0	20.60	1.80	37.00
Aug. 29	do	do	do	22.0	14.20	1.57	22.00
Nov. 17	do	do	do	22.0	14.90	1.16	17.30
Dec. 6	do	do	do	23.0	15.80	1.12	17.70
Feb. 25	H. W. Rowley	Lyons creek	NE. 35-7-4-5	10.0	5.60	0.93	5.20
Mar. 14	do	do	do	17.0	20.70	1.20	25.00
Mar. 24	J. M. Paul	do	do	10.0	7.90	1.95	15.40
June 5	W. M. Edwards	do	do	21.0	26.00	3.25	84.00
July 3	do	do	do	20.5	17.10	2.57	44.00
Aug. 1	do	do	do				Nil
Aug. 29	do	do	do				Nil
Nov. 17	do	do	do				Nil
Feb. 9	H. W. Rowley	Nez Percé creek	NW. 17-8-4-5	3.7	1.60	0.42	0.67
Mar. 13	do	do	do	6.0	2.10	0.56	1.18
Mar. 23	J. M. Paul	do	do	5.0	2.50	1.12	2.80
May 9	W. M. Edwards	do	do	14.5	11.40	2.83	32.00
June 6	do	do	do	14.0	11.50	2.63	30.00
July 4	do	do	do	15.0	11.60	2.30	27.00
Aug. 2	do	do	do	6.0	6.10	0.42	2.57
Aug. 30	do	do	do	4.0	1.55	1.43	2.20
Nov. 16	do	do	do	1.5	0.38	1.68	0.64
Dec. 22	E. J. Switzer	do	do	2.0	0.92	0.39	0.36
Jan. 27	H. W. Rowley	York creek	NW. 34-7-4-5				0.15*e*
Feb. 24	do	do	do	8.0	4.0	0.88	3.50
Mar. 13	do	do	do	12.0	8.50	1.44	12.20
Mar. 23	J. M. Paul	do	do	18.0	8.60	1.02	8.80
April 14	do	do	do	23.0	19.30	2.38	46.00
June 6	W. M. Edwards	do	do	26.0	24.20	3.54	86.00
July 3	do	do	do	26.5	28.30	3.80	108.00
Aug. 2	do	do	do	18.0	12.20	1.52	18.60
Aug. 30	do	do	do	14.0	8.60	0.92	8.00
Nov. 16	do	do	do				Nil
Dec. 7	do	do	do				Nil

NOTE.—*w* Discharge determined by using an 18-inch weir.
e Discharge estimated.

WATERTON RIVER DRAINAGE BASIN

General Description

Waterton river rises in the northwestern portion of the state of Montana, on the eastern slope of the Rocky mountains. It flows in a northerly direction and, passing through a chain of lakes near the international boundary, known as Waterton lakes, it continues in a north and easterly direction and finally empties into Belly river near Stand Off, Alberta.

The topography of the basin is of a varied character ranging from the mountainous regions of Montana to the rolling prairie of Southern Alberta. The tributaries are mostly in the upper portion of the basin, near the international boundary and from the west side.

There is a large snowfall in the upper portion of the basin, and the melting of this combined with heavy rains often causes floods on this river in the early summer. Thereafter the river steadily decreases in volume, until the minimum is reached about mid-winter.

The names of the principal tributaries of this stream are the Little Kootenay, which rises in Montana and empties into the south end of the Waterton lake; Boundary creek, and East Boundary creek, two small streams emptying into the upper Waterton lake from the west and east slopes, are south of the international boundary; Hell Roaring creek is a small stream in Canada flowing into the upper Waterton lake from the east slope; Bertha creek is a small tributary mostly snow fed, from the west slope of the upper lake and originating solely in Canada; Cameron, or Oil creek as it is called locally, has its head in Cameron lake, a body of water divided by the international boundary; Blakiston brook, a stream locally called Pass creek, rises wholly in Canada and is a steady source of supply to the waters of the Waterton river; Crooked creek drains the northeast slope of Sheep mountain and the nearby foot-hills until it flows into the Waterton river, one mile below the lakes on the east slope; Pine creek, Yarrow creek and Drywood river are the chief tributaries of the river system from foot-hills on the west slope.

Waterton lakes offer a very favourable site for a storage reservoir, approximately fourteen miles long and one mile wide. The steep, rocky banks of the narrows is an ideal site for the construction of a dam. The flow could be more than doubled during the late summer months and used for irrigation purposes, or a small power project could easily be developed.

CAMERON CREEK AT WATERTON PARK

Location.—On the SW. ¼ Sec. 23, Tp. 1, Rge. 30, W. 4th Mer., at Waterton Park.

Records available.—January 1 to December 31, 1916.

Gauge.—Vertical staff, maintained at elevation 95.97 feet to March 8; at 90.76-4,215.88 above mean sea-level to June 15, on vertical staff, and to November 10, on chain gauge; November 11 to December 31, on winter vertical staff, maintained at 4,218.08. Gauge read by C. S. Danielson.

Bench-mark.—Permanent iron; elevation maintained at 4,227.24 feet above mean sea-level.

Channel.—Permanent.

Discharge measurements.—At low stages by wading; at high stages from cable.

Winter flow.—Obtained through the ice at cable.

DISCHARGE MEASUREMENTS of Cameron creek at Waterton park, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 2	W. H. Storey	26.5	11.7	1.65	0.40*b*	19.3
Jan. 27	V. A. Newhall	18.0	11.0	1.47	0.07*b*	16.1
Mar. 10	do	21.5	30.5	0.93	1.68*x*	29.0
Mar. 28	S. H. Frame	28.0	28.3	1.14	1.19	32.0
April 19	do	24.0	31.3	1.60	1.41	50.0
May 20	do	44.0	66.9	2.18	2.10	146.0
June 10	do	50.0	106.0	4.20	3.00	445.0
June 12	do	49.0	94.4	3.29	2.66	309.0
July 8	do	51.0	84.0	3.88	2.72	326.0
July 31	do	42.0	38.2	1.90	1.69	72.0
Aug. 26	do	32.0	30.8	1.77	1.56	54.0
Sept. 14	do	38.0	31.6	1.67	1.51	53.0
Oct. 5	do	27.0	18.5	0.96	1.20*x*	17.7
Dec. 1	H. W. Rowley	20.0	25.6	0.82	0.26*b*	21.0
Dec. 21	do	18.0	14.0	1.08	0.10*b*	15.2

b Ice conditions.
x New gauge 100 feet down stream.

DAILY GAUGE HEIGHT AND DISCHARGE of Cameron creek at Waterton Park, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....*b*	19.0*e*	0.07	16.1	0.07	16.0	1.12	19.2	1.84	94	2.00	123
2	0.40	19.3*d*	0.07	16.1	0.07	16.0	1.10	18.0	2.14	152	2.20	166
3	0.30	18.3	0.06	16.0	0.07	16.0	1.10	18.0	2.32	197	2.44	231
4	0.10	16.4	0.05	15.9	0.07	16.0	1.10	18.0	2.50	250	2.95	424
5	0.08	16.2	0.05	15.9	0.08	16.5	1.07	16.5	2.63	296	3.00	446
6	0.07	16.1	0.04	15.8	0.09	16.8	1.05	15.5	2.75	342	2.50	250
7	0.07	16.1	0.04	15.8	0.15	19.0	1.12	19.2	2.88	395	2.40	219
8	0.05	15.9	0.03	15.7	0.24*x*	20.0*e*	1.21	25.0	2.90	403	2.78	353
9	0.05	15.9	0.03	15.7	.....	24.0	1.28	30.0	2.50	250	3.05	468
10	0.05	15.9	0.01	15.5	1.68	29.0*d*	1.32	34.0	2.00	123	3.10	491
11	0.06	16.0	0.02	15.6	1.50	50.0	1.35	36.0	1.85	96	2.85	382
12	0.10	16.4	0.04	15.8	1.70	74.0	1.35	36.0	1.75	81	2.60	285
13	0.07	16.1	0.06	16.0	1.70	74.0	1.35	36.0	1.70	74	2.80	361
14	0.07	16.1	0.42	19.5	1.40	40.0	1.35	36.0	1.66	69	3.00	446
15	0.06	16.0	0.82	26.0	1.20	24.0	1.38	38.0	1.62	64	3.35	611
16	0.06	16.0	0.60*b*	21.0	1.20	24.0	1.54	54.0	1.60	61	3.60	745
17	0.05	15.9	8.07*g*	120.0	1.19	23.0	1.48	48.0	1.56	57	3.70	800
18	0.05	15.9	6.10*g*	100.0	1.17	22.0	1.43	43.0	1.70	74	3.75	828
19	0.04	15.8	3.04	90.0	1.18	23.0	1.41	41.0	1.95	114	3.40	636
20	0.03	15.7	1.06	80.0	1.20	24.0	1.39	39.0	2.10	143	3.10	491
21	0.04	15.8	0.50	50.0	1.27	30.0	1.37	38.0	2.18	161	3.05	468
22	0.02	15.6	0.04	12.0	1.25	28.0	1.37	38.0	2.10	143	3.01	450
23	0.01	15.5	0.00	5.0	1.30	32.0	1.30	32.0	2.00	123	2.94	420
24	0.01	15.5	−0.04	4.0	1.25	28.0	1.27	30.0	1.98	119	2.90	403
25	0.01	15.5	−0.07	3.0	1.22	26.0	1.30	32.0	1.95	114	2.90	403
26	0.02	15.6	0.01	6.0	1.20	24.0	1.43	43.0	1.95	114	3.00	446
27	0.05	15.9	0.04	12.0	1.20	24.0	1.56	57.0	2.00	123	3.03	460
28	0.06	16.0	0.07	16.0	1.19	23.0	1.70	74.0	2.12	148	3.37	621
29	0.08	16.2	0.07	16.0	1.29	31.0	1.92	108.0	2.25	178	3.22	547
30	0.07	16.1	.....	.....	1.20	24.0	1.88	101.0	2.19	164	3.03	460
31	0.08	16.2	.....	.....	1.15	21.0	.....	.....	2.10	143	.....	.....

b-b Ice conditions.
d Actual measurement.
e-e Discharge estimated from notes and discharge measurements.
g-g Ice jam.
x-x New gauge 100 feet down stream.

DAILY GAUGE HEIGHT AND DISCHARGE of Cameron creek at Waterton Park, for 1916—*Concluded*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1....	2.84	378	1.68	71	1.41	41	1.15	21.0	1.16	22.0	0.26	21.00
2....	2.87	390	1.68	71	1.39	39	1.11	18.6	1.16	22.0	0.24	20.00
3....	2.94	420	1.67	70	1.46	46	1.10	18.0	1.14	20.0	0.19	18.80
4....	2.79	357	1.62	64	2.29	188	1.18	23.0	1.13	19.8	0.20	19.20
5....	2.71	326	1.58	59	2.11	145	1.20	24.0	1.13	19.8	0.22	20.00
6....	2.66	307	1.56	57	2.00	123	1.21	25.0	1.15	21.0	0.24	21.00
7....	2.63	296	1.52	52	1.89	102	1.23	26.0	1.14	20.0	0.24	21.00
8....	2.76	345	1.71	75	1.77	84	1.20	24.0	1.14	20.0	0.23	20.00
9....	2.74	338	1.71	75	1.73	78	1.17	22.0	1.15	21.0	0.57	34.00
10....	2.73	334	1.71	75	1.68	71	1.13	19.8	1.18	23.0	1.05	53.00
11....	2.59	282	1.68	71	1.63	65	1.11	18.6	1.70*b*	79.0	0.30	29.00
12....	2.66	307	1.62	64	1.57	58	1.12	19.2	1.70	79.0	0.24	21.00
13....	2.66	307	1.55	56	1.53	53	1.08	17.0	1.50	71.0	0.17	18.00
14....	2.59	282	1.53	53	1.51	51	1.09	17.5	1.00	51.0	0.18	18.40
15....	2.46	238	1.51	51	1.46	46	1.12	19.2	0.50	31.0	0.16	17.60
16....	2.29	188	1.49	49	1.43	43	1.12	19.2	0.46	29.0	0.14	16.80
17....	2.26	181	1.55	56	1.42	42	1.14	20.0	0.35	25.0	0.14	16.80
18....	2.21	168	1.67	70	1.41	41	1.12	19.2	0.28	22.0	0.14	16.80
19....	2.17	159	1.67	70	1.41	41	1.12	19.2	1.10	55.0	0.14	16.80
20....	2.11	145	1.63	65	1.42	42	1.15	21.0	1.10	55.0	0.12	16.00
21....	2.04	131	1.58	59	1.40	40	1.18	23.0	0.89	47.0	0.10	15.20
22....	1.99	121	1.55	56	1.40	40	1.20	24.0	0.59	35.0	0.28	22.00
23....	1.94	112	1.52	52	1.40	40	1.20	24.0	0.38	26.0	0.20	19.20
24....	1.89	102	1.47	47	1.39	39	1.23	26.0	0.30	23.0	0.14	16.80
25....	1.86	98	1.44	44	1.39	39	.....	26.0*e*	0.29	23.0	0.10	15.20
26....	1.82	91	1.56	57	1.38	38	.....	26.0*e*	0.27	21.0	0.06	9.00
27....	1.79	87	1.53	53	1.38	38	.....	25.0*e*	0.24	20.0	0.05	7.50
28....	1.78	85	1.52	52	1.39*x*	39	1.21	25.0	0.21	19.6	0.04	6.00
29....	1.77	84	1.49	49	.....	33*e*	1.23	26.0	0.22	20.0	0.02	3.00
30....	1.70	74	1.46	46	.....	27*e*	1.21	25.0	0.25	21.0	0.01	1.50
31....	1.69	73	1.42	42	.....	.....	1.18	23.0	.....	.....	0.00*b*	1.00

b-b Ice conditions, Nov. 11 to Dec. 31.
e Discharge estimated.
Winter staff gauge reduced to chain gauge height, Oct. 1 to Nov. 11.
Winter staff gauge heights, Nov. 11 to Dec. 31, discharge estimated from measurements.

MONTHLY DISCHARGE of Cameron creek at Waterton Park, for 1916

(Drainage area 27 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	19.3	15.50	16.2	0.600	0.69	996
February	120.0	3.00	27.0	1.000	1.08	1,553
March	74.0	16.00	28.0	1.040	1.20	1,722
April	108.0	15.50	39.0	1.440	1.61	2,321
May	403.0	57.00	157.0	5.810	6.70	9,654
June	828.0	123.00	448.0	16.590	18.51	26,658
July	420.0	73.00	220.0	8.150	9.40	13,527
August	75.0	42.00	59.0	2.180	2.51	3,628
September	188.0	27.00	59.0	2.180	2.43	3,511
October	26.0	17.00	22.0	0.815	0.94	1,353
November	79.0	19.60	32.0	1.180	1.32	1,904
December	53.0	1.00	21.0	0.778	0.90	1,291
The year	.....	.....	.....	.....	47.29	68,118

WATERTON RIVER NEAR WATERTON PARK

(Formerly called "Waterton river at Waterton Mills")

Location.—On the NE. ¼ Sec. 8, Tp. 2, Rge. 29, W. 4th Mer., near Waterton Mills.

Records available.—August 26, 1908, to December 31, 1916.

Gauge.—Vertical staff. Zero of gauge maintained at 4,153.07 feet during 1908-1912. Zero gauge maintained at 4,152.87 feet during 1913-16.

Remarks.—Waterton Mills P.O. has been closed and gauging station is now near Waterton Park P.O.

Bench-mark.—Permanent iron bench-mark, located within six feet of the gauge, elevation 4,162.56 feet above mean sea-level (Irrigation Surveys datum).

Channel.—Composed of rocks, stone and gravel; not liable to shift.

Discharge measurements.—Made from a cable car at ordinary stages and by wading at very low stages.

Winter flow.—The high velocity prevents a complete ice cover at the gauge during the winter and open water measurements are obtained.

Observer.—W. E. MacDonald, Waterton Park P.O., Alta.

DISCHARGE MEASUREMENTS of Waterton river near Waterton Park, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 1	W. H. Storey	140	316.0	0.63	2.93	191
Jan. 28	V. A. Newhall	97	84.8	1.36	2.54	115
Mar. 11	do	135	218.0	1.04	2.88	227
Mar. 30	S. H. Frame	210	276.0	1.64	3.13	452
April 20	do	150	481.0	1.22	3.31	557
May 22	do	149	613.0	1.81	3.80	1,080
June 12	do	160	848.0	3.40	4.66	2,776
July 8	do	160	805.0	4.19	4.90	3,325
July 29	do	150	466.0	2.10	3.70	965
Aug. 25	do	140	372.0	1.60	3.34	585
Sept. 13	do	140	371.0	1.56	3.35	568
Oct. 6	do	126	232.0	0.92	2.78	199
Dec. 1	H. W. Rowley	43	41.2	1.02	2.11	42
Dec. 20	do	41	61.0	2.33	2.52	143

DAILY GAUGE HEIGHT AND DISCHARGE of Waterton river near Waterton Park, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.93	264	2.62	140	2.73	174	3.02	318	x	962e	3.97	1,361
2	2.69	161	2.64	145	2.71	167	3.01	312	.....	1,111e	3.95	1,325
3	2.58	129	2.68	158	2.68	158	2.97	287	.....	1,260e	4.00	1,414
4	2.56	124	2.66	151	2.71	167	2.94	269	.....	1,409e	4.17	1,738
5	2.33	74	2.65	148	2.72	171	2.96	281	.....	1,557e	4.40	2,212
6	2.61	137	2.64	145	2.73	174	2.95	275	.....	1,705e	4.47	2,362
7	2.53	116	2.60	134	2.70	164	2.94	269	.....	1,853e	4.40	2,212
8	2.52	114	2.68	158	2.71	167	2.93	264	4.30	2,001	4.43	2,276
9	2.50	109	2.66	151	2.83	213	2.95	275	.....	1,871e	4.55	2,536
10	2.50	109	2.68	158	2.43	94	2.98	293	.....	1,741e	4.74	2,959
11	2.52	114	2.68	158	2.88	237	3.01	312	.....	1,611e	4.76	3,005
12	2.54	119	2.69	161	2.93	264	3.17	427	.....	1,481e	4.66	2,779
13	2.52	114	2.64	145	2.98	293	3.18	434	.....	1,351e	4.63	2,713
14	2.52	114	2.62	140	2.95	275	3.20	450	.....	1,222e	4.78	3,050
15	2.52	114	2.75	181	2.94	269	3.24	484	.....	1,093e	4.95	3,439
16	2.51	111	2.78	192	2.96	281	3.26	501	x	964e	5.35	4,350
17	2.51	111	2.81	204	2.99	299	3.32	553	3.60	835	5.65	5,034
18	2.50	109	2.83	213	3.03	325	3.32	553	3.57	802	5.73	5,216
19	2.52	114	2.81	204	3.05	338	3.32	553	3.68	930	6.10	6,060
20	2.53	116	2.78	192	3.08	360	3.31	544	3.70	954	6.00	5,832
21	2.52	114	2.77	189	3.14	404	3.31	544	3.80	1,088	5.80	5,376
22	2.50	109	2.79	196	3.17	427	3.30	535	3.80	1,088	5.65	5,034
23	2.54	119	2.81	204	3.10	374	3.26	501	3.80	1,088	5.10	3,780
24	2.59	131	2.83	213	3.05	338	3.23	475	3.84	1,147	5.00	3,552
25	2.58	129	2.82	209	3.06	345	3.22	467	3.89	1,225	4.49	2,405
26	2.56	124	2.78	192	3.02	318	3.31	544	3.84	1,147	5.00	3,552
27	2.54	119	2.75	181	3.03	325	3.32	553	3.79	1,074	5.13	3,848
28	2.54	119	2.80	200	3.04	331	3.42	647	3.83	1,132	5.36	4,373
29	2.55	121	2.78	192	3.08	360	3.50	727	3.90	1,241	5.43	4,532
30	2.55	121	.....	.....	3.13	396	3.58	813	3.90	1,241	5.36	4,373
31	2.58	129	.....	.....	3.05	338	.....	.....	3.89	1,225	.....	.....

e Discharge estimated.
x-x No observer.

DAILY GAUGE HEIGHT AND DISCHARGE of Waterton river near Waterton Park, for 1916—*Concluded*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	5.38	4,418	3.74	1,006	3.34	571	2.90	247	2.85	222	2.11	42
2	5.36	4,373	3.65	893	3.34	571	2.87	232	2.86	227	.....	48*e*
3	6.00	5,832	3.60	835	3.35	580	2.86	227	2.85	222	.....	54*e*
4	4.55	2,536	3.58	813	3.40	627	2.90	247	2.84	218	.....	62*e*
5	4.50	2,427	3.55	780	3.55	780	2.86	227	2.83	213	.....	68*e*
6	4.46	2,341	3.54	769	3.56	791	2.78	192	2.84	218	.....*x*	72*e*
7	4.73	2,937	3.52	748	3.57	802	2.85	222	2.84	218	2.34	76
8	4.90	3,324	3.50	727	3.57	802	2.84	218	2.85	222	2.34	76
9	4.95	3,438	3.55	780	3.54	769	2.82	209	2.85	222	2.34	76
10	4.93	3,392	3.55	780	3.50	727	2.80	200	2.00	213*e*	2.59	131
11	4.85	3,210	3.54	769	3.50	727	2.79	196	1.80	204*e*	2.48	105
12	4.75	2,982	3.55	780	3.40	627	2.78	192	.....*x*	195*e*	2.48	105
13	4.77	3,028	3.50	727	3.35	580	2.75	181	.....	186*e*	2.48	105
14	4.70	2,869	3.45	676	3.45	676	2.74	178	.....	178*e*	2.48	105
15	4.60	2,646	3.42	647	3.40	627	2.73	174	.....	170*e*	2.48	105
16	4.50	2,427	3.40	627	3.35	580	2.73	174	.....	162*e*	2.48	105
17	4.43	2,274	3.40	627	3.30	535	2.72	171	.....	154*e*	2.48	105
18	4.35	2,106	3.42	647	3.29	526	2.73	174	.....	146*e*	2.46	100
19	4.25	1,898	3.45	676	3.15	411	2.75	181	.....	138*e*	2.43	94
20	4.20	1,797	3.40	627	3.15	411	2.78	192	.....	130*e*	2.52	114
21	4.05	1,506	3.40	627	3.15	411	2.70	164	.....	122*e*	2.51	111
22	4.05	1,506	3.35	580	3.15	411	2.67	154	.....	114*e*	2.48	105
23	4.00	1,414	3.34	571	3.15	411	2.66	151	.....	106*e*	2.49	107
24	3.97	1,361	3.36	589	3.15	411	2.66	151	.....	98*e*	2.49	107
25	3.90	1,241	3.34	571	3.10	374	2.68	158	.....	90*e*	2.49	107
26	3.89	1,225	3.36	589	2.98	293	2.69	161	.....	82*e*	2.49	107
27	3.89	1,225	3.34	571	2.95	275	2.70	164	.....	74*e*	2.48	105
28	3.87	1,194	3.33	562	2.93	264	2.75	181	.....	66*e*	2.63	142
29	3.70	954	3.32	553	2.90	247	2.80	200	.....	58*e*	2.63	142
30	3.60	835	3.32	553	2.90	247	2.84	218	.....	50*e*	2.63	142
31	3.65	893	3.32	553	.....	.....	2.85	222	.....	.....	2.48	105

e Discharge estimated.
x-x River frozen to bottom at rod, no gauge reading.

MONTHLY DISCHARGE of Waterton river near Waterton Park, for 1916

(Drainage area 214 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	264	74	123	0.575	0.66	7,563
February	213	134	174	0.913	0.88	10,009
March	427	94	276	1.290	1.49	16,971
April	813	264	449	2.100	2.34	26,717
May	2,001	902	1,271	5.940	6.85	78,151
June	6,060	1,325	3,423	16.000	17.85	203,684
July	5,832	835	2,374	11.090	12.79	145,972
August	1,006	553	686	3.210	3.70	42,180
September	802	247	535	2.500	2.79	31,835
October	247	151	192	0.897	1.03	11,806
November	227	50	157	0.734	0.82	9,342
December	142	42	98	0.458	0.53	6,026
The year	.....	.....	.....	.....	51.73	590,256

MEAN MONTHLY DISCHARGE in Second-feet of Waterton river at Waterton Mills

MONTH	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	457	330	384	856	539	192	460	28,264
November	.....	132*b*	371	267	536	384	157	343	20,406
December	.....	.....	181	179	201	197	98	171	10,525
January	.....	245	121	161	111	123	.....	152	9,358
February	.....	217	110	134	91	174	.....	145	8,218
March	.....	112	110	131	92	276	.....	144	8,867
April	1,035*a*	364	373	611	548	449	.....	469	27,907
May	1,650	1,509	1,577	1,913	1,369	1,271	.....	1,548	95,195
June	3,106	1,744	3,383	1,993	1,713	3,423	.....	2,560	152,348
July	1,136	1,205	1,133	905	981	2,374	.....	1,289	79,258
August	744	454	638	431	496	686	.....	575	35,345
September	1,255	270	273	394	507	535	.....	539	32,072
Total in acre-ft.	501,130	399,879	519,404	454,066	454,124	631,163	.....	.....	507,763

a 19-30.
b 1-4.

CROOKED CREEK NEAR WATERTON PARK

Location.—On the SW. ¼ Sec. 22, Tp. 2, Rge. 29, W. 4th Mer.

Records available.—September 15, 1909, to October 31, 1916.

Gauge.—Vertical staff. Zero of gauge maintained at elevation of 89.48 feet during 1913-1916. For previous gauge data refer to previous reports.

Bench-marks.—Permanent iron bench-mark located on the right bank, twenty-five feet from the gauge; assumed elevation 100.00 feet.

Channel.—Consists of sand, gravel and small stones, not liable to shift.

Discharge measurements.—Made with current-meter, by wading at low stages, and from highway bridge about one mile down stream from the gauge at high stages.

Winter flow.—No records are taken during winter season.

Observer.—W. E. McDonald.

DISCHARGE MEASUREMENTS of Crooked creek near Waterton Park, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 28	S. H. Frame	14.5	14.70	1.67	2.12	25.0
April 18	do	15.0	18.50	1.64	2.22	30.0
May 16	do	16.0	20.60	1.76	2.36	37.0
May 22	do	15.0	17.20	1.15	2.21	30.0
June 10	do	15.0	24.10	4.54	3.10	109.0
June 12	do	20.0	54.80	1.89	3.03	104.0
July 8	do	16.0	27.50	1.75	2.50	49.0
July 29	do	14.0	16.80	0.85	1.96	14.3
Aug. 25	do	14.0	15.00	0.55	1.81	8.2
Sept. 13	do	14.0	16.40	0.64	1.85	10.5
Oct. 6	do	15.0	17.60	0.77	1.98	13.5

DAILY GAUGE HEIGHT AND DISCHARGE of Crooked creek near Waterton Park, for 1916

DAY	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft*
1	.....	.....	.....	200.0*x*	2.50	49.0	2.99	99.0
2	.....	.....	4.31	236.0*x*	2.55	54.0	2.89	88.0
3	.....	.....	2.30	34.0	2.46	46.0	2.79	78.0
4	.....	.....	2.32	35.0	2.40	41.0	2.76	75.0
5	.....	.....	2.30	34.0	2.38	39.0	2.93	92.0
6	.....	.....	2.32	35.0	2.38	39.0	3.19	119.0
7	.....	.....	2.58	57.0	2.40	41.0	3.98	202.0
8	.....	.....	2.32	35.0	2.75	74.0	2.82	81.0
9	.....	.....	2.06	19.1	2.39	40.0	2.77	76.0
10	.....	.....	2.36	38.0	2.36	38.0	3.10	110.0
11	.....	.....	.....	38.0*e*	2.38	39.0	3.33	134.0
12	.....	.....	.....	38.0*e*	2.38	39.0	3.03	103.0
13	.....	.....	2.36	38.0	2.31	34.0	3.19	119.0
14	.....	.....	2.03	17.6	2.32	35.0	2.81	80.0
15	.....	.....	2.32	35.0	2.37	39.0	2.80	79.0
16	.....	.....	2.30	34.0	2.37	39.0	2.88	87.0
17	.....	.....	2.30	34.0	2.31	34.0	2.86	85.0
18	.....	.....	2.22	28.0	2.27	31.0	2.83	82.0
19	.....	.....	2.15	24.0	2.23	29.0	3.03	103.0
20	.....	.....	2.19	26.0	2.27	31.0	2.98	98.0
21	.....	.....	2.25	30.0	2.28	32.0	2.97	97.0
22	.....	.....	2.30	34.0	2.30	34.0	2.83	82.0
23	.....	.....	2.18	26.0	2.32	35.0	2.78	77.0
24	.....	.....	2.15	24.0	2.37	39.0	2.78	77.0
25	.....	.....	2.16	24.0	2.72	71.0	2.76	75.0
26	.....	.....	2.18	26.0	2.79	78.0	2.76	75.0
27	.....	.....	2.15	24.0	3.12	112.0	2.88	87.0
28	2.13	23.0	2.25	30.0	3.38	139.0	2.96	96.0
29	.....	29.0*e*	2.30	34.0	3.12	112.0	2.63	62.0
30	2.32	35.0	2.30	34.0	3.02	102.0	2.08	20.0
31	2.16	24.0	.....	.....	3.00	100.0	.....	.....

e Discharge estimated.
x Melting snow.

DAILY GAUGE HEIGHT AND DISCHARGE of Crooked creek near Waterton Park, for 1916
—*Concluded*

Day	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.29	33.0	1.90	12.10	1.89	11.80	1.70	6.20
2	2.86	85.0	1.89	11.80	1.90	12.10	1.69	6.00
3	2.79	78.0	1.85	10.40	1.90	12.10	1.69	6.00
4	2.82	81.0	1.80	8.80	1.91	12.50	1.70	6.20
5	2.94	93.0	1.73	6.90	1.93	13.30	1.70	6.20
6	2.90	89.0	1.70	6.20	1.94	13.70	1.98	15.40
7	2.94	93.0	1.64	5.00	1.92	12.90	1.65	5.20
8	2.50	49.0	1.54	3.40	1.93	13.30	1.65	5.20
9	2.44	44.0	1.10	0.30	1.90	12.10	1.64	5.00
10	2.42	43.0	1.79	8.50	1.90	12.10	1.65	5.20
11	2.34	36.0	1.80	8.80	1.89	11.80	1.70	6.20
12	2.29	33.0	1.85	10.40	1.85	10.40	1.73	6.90
13	2.30	34.0	2.05	18.60	1.85	10.40	1.77	8.00
14	2.24	29.0	1.95	14.10	1.84	10.10	1.84	10.10
15	3.28	129.0	1.85	10.40	1.83	9.80	1.90	12.10
16	3.17	117.0	1.85	10.40	1.81	9.10	1.89	11.80
17	3.00	100.0	1.84	10.10	1.82	9.40	1.87	11.10
18	2.79	78.0	1.85	10.40	1.82	9.40	1.90	12.10
19	2.73	72.0	1.80	8.80	1.75	7.40	1.92	12.90
20	2.55	54.0	1.80	8.80	1.75	7.40	1.80	8.80
21	2.55	54.0	1.80	8.80	1.70	6.20	1.05	0.10
22	2.48	48.0	1.79	8.50	1.70	6.20	1.05	0.10
23	2.29	33.0	1.80	8.80	1.69	6.00	1.97	14.90
24	2.21	28.0	1.80	8.80	1.70	6.00	1.97	14.90
25	2.17	25.0	1.81	9.10	1.75	7.40	1.96	14.50
26	2.06	19.1	1.85	10.40	1.75	7.40	1.95	14.10
27	2.03	17.6	1.90	12.10	1.73	6.90	1.93	13.30
28	1.96	14.5	1.90	12.10	1.73	6.90	1.90	12.10
29	1.96	14.5	1.89	11.80	1.70	6.20	1.93	13.30
30	1.89	11.8	1.89	11.80	1.70	6.20	1.95	14.10
31	1.90	12.1	1.90	12.10	.....	.....	1.95	14.10

MONTHLY DISCHARGE of Creeked creek near Waterton Park, for 1916

(Drainage area 26 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (28-31)	35.0	23.00	28.0	1.070	0.16	222
April	236.0	17.60	44.0	1.690	1.88	2,618
May	139.0	29.00	54.0	2.070	2.39	3,213
June	202.0	20.00	91.0	3.500	3.40	5,415
July	129.0	11.80	53.0	2.040	2.35	3,259
August	18.6	0.30	9.6	0.369	0.43	590
September	13.7	6.00	9.6	0.369	0.43	590
October	15.4	0.10	9.4	0.362	0.42	578
The period	.....	.....	.....	.....	11.46	16,485

WATERTON RIVER NEAR STAND OFF

Location.—On NW. ¼ Sec. 28, Tp. 6, Rge. 25, W. 4th Mer., about three-quarter mile below the bridge on the Macleod trail.

Records available.—November 5, 1915, to December 31, 1916.

Gauge.—Vertical staff to April 2, 1916; open chain gauge April 3 to December 31, 1916. Zero maintained at elevation of 90.11 feet since establishment. Gauge is read by E. Cuthbert Bellerby.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet to July 14, 1916, and 102.10 from July 14, 1916, to date.

Channel.—Composed of boulders and gravel, shifted considerably during June floods.

Discharge measurements.—Made with current-meter from cable car.

Winter flow.—Measurements made under cable at regular station.

Accuracy.—Stage-discharge relation permanent except during extreme flood conditions. Rating curve well defined between zero flow and 10,500 second-feet. Gauge read to hundredths daily, and with greater frequency during high water. Daily discharge ascertained by applying mean daily gauge heights to rating table; by Bolster method June 24 to June 28; and during ice conditions by applying to hydrograph mean daily gauge heights, discharge measurements and temperatures.

DISCHARGE MEASUREMENTS of Waterton river near Stand Off, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 18	W. H. Storey	111	173	1.27	2.68*b*	221
Feb. 17	V. A. Newhall	158	727	3.25	5.20*b*	2,394
April 4	S. H. Frame	125	282	2.77	2.02	782
May 6	do	140	400	4.36	2.92	1,745
June 15	do	151	599	6.81	4.43	4,079
June 22	W. A. Burton	311	1,218	8.61	6.12	10,484
June 24	do	175	773	6.69	4.98	5,173
June 25	do	174	730	6.18	4.74	4,509
June 26	do	174	732	6.14	4.72	4,496
June 27	do	175	752	6.40	4.82	4,811
June 28	do	178	813	7.04	5.33	5,721
June 29	do	181	818	7.71	5.52	6,308
June 29	do	181	839	8.00	5.66	6,714
July 13	S. H. Frame	180	664	5.50	4.41	3,652
Aug. 3	do	122	363	2.48	2.50	902
Sept. 1	W. A. Burton	115	323	1.91	2.06	617
Sept. 22	S. H. Frame	111	304	1.49	1.84	453
Nov. 27	H. W. Rowley	120	326	0.99	3.00*b*	322
Dec. 16	do	115	138	1.48	2.75*b*	205

b Ice conditions.

PLATE 9

View showing conditions at the gauging station on Waterton river near Stand Off, during the break-up in February, 1916. Taken on February 16, 1916, by V. A. Newhall.

PLATE 10

Another view of the conditions at the gauging station on Waterton river near Stand Off, showing the ice deposited on the left bank. Taken on February 16, 1916, by V. A. Newhall.

DAILY GAUGE HEIGHT AND DISCHARGE of Waterton river near Stand Off, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.09*b*	230	2.98	184	2.82	400	2.02	788	2.49	1,228	3.46	2,508
2	1.82	220	2.94	196	2.84*b*	420	2.24	975	2.50	1,239	3.22	2,166
3	2.04	215	2.99	208	3.44	380	2.01	780	2.52	1,262	3.15	2,068
4	2.28	212	3.05	219	3.57	360	2.02	788	2.59	1,342	3.60	2,714
5	2.29	212	2.98	225	3.56	340	1.93	720	2.76	1,546	4.13	3,556
6	2.34	215	2.99	230	3.46	300	1.96	742	2.94	1,779	4.24	3,743
7	2.23	221	2.98	242	3.52	340	1.95	735	3.27	2,236	3.95	3,258
8	2.34	222	2.98	252	3.51	335	1.94	728	3.37	2,378	3.83	3,066
9	2.36	215	2.97	254	3.49*b*	360	1.92	713	3.30	2,278	4.03	3,389
10	2.36	204	3.11	255	5.99*gc*	1,000*e*	1.94	728	3.15	2,068	4.43	4,075
11	2.39	201	3.12	257	4.42	900	1.94	728	3.05	1,929	4.38	3,986
12	2.43	201	3.07	260	4.15	860	1.95	735	2.91	1,738	4.15	3,590
13	2.51	202	3.08	265	3.89	840	1.95	735	2.75	1,534	4.11	3,522
14	2.54	206	3.07	320	3.55	800	1.94	728	2.67	1,436	4.08	3,472
15	2.56	211	3.04*g*	1,100	2.92	900	2.02	788	2.57	1,319	4.46	4,128
16	2.59	218	.....	1,800*e*	2.14	886	2.00	772	2.50	1,239	4.94	5,088
17	2.65	220	5.20*b*	2,400	2.02	788	2.02	788	2.42	1,159	5.20	5,718
18	2.68	221	4.44	2,000	1.92	713	2.03	796	2.36	1,091	5.45	6,456
19	2.79	221	3.92	1,600	1.94	728	2.02	788	2.40	1,131	5.65	7,180
20	2.81	221	3.87	1,200	2.01	780	2.00	772	2.46	1,196	5.92	7,976
21	2.80	210	3.52	1,000	2.11	861	2.00	772	2.55	1,296	6.06	9,896
22	2.78	198	3.30	800	2.08	836	2.04	804	2.65	1,413	6.12	10,502
25	2.80	185	3.33	750	2.06	820	1.98	757	2.70	1,472	5.21	5,746
24	2.69	170	3.47	800	1.89	691	1.96	742	2.81	1,609	4.92	5,044
25	2.75	158	3.41	750	1.82	643	1.95	735	3.23	2,180	4.75	4,509*d*
26	2.90	150	3.13	600	1.85	663	1.94	728	3.25	2,208	4.74	4,496*d*
27	2.90	150	2.90	500	1.89	691	1.94	728	3.27	2,236	4.79	4,811*d*
28	2.92	153	2.87	460	1.86	670	2.14	886	3.33	2,321	5.36	5,721*d*
29	2.95	158	2.82	400	2.02	788	2.24	975	3.39	2,407	5.53	6,510*d*
30	2.94	167	.....	.....	1.92	713	2.36	1,091	3.44	2,479	5.31	5,666
31	2.99	172	.....	.....	1.94	728	.....	.....	3.24	2,194	.....	.....

b-b Ice conditions from January 1 to February 17; March 2 to March 9.
e Discharge estimated by field inspection.
g Ice going out.
c Backwater from ice jam.
d Actual measurement.

DAILY GAUGE HEIGHT AND DISCHARGE of Waterton river near Stand Off, for 1916.—*Concluded.*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	5.00	4,922	2.48	894	2.06	590	1.59	346	1.45	289	2.17	297
2	4.94	4,787	2.41	838	2.03	571	1.57	337	1.48	300	2.10	294
3	5.00	4,922	2.50	910	2.14	641	1.61	355	1.51	311	2.64	293
4	4.94	4,787	.....*x*	896	2.37	807	1.61	355	1.54	324	2.43	290
5	4.78	4,434	.....	882	2.65	1,041	1.61	355	1.48	300	2.16	287
6	4.62	4,096	.....	868	2.65	1,041	1.61	355	1.46	293	2.36	282
7	4.49	3,830	.....	854	2.65	1,041	1.62	359	1.46	293	2.28	275
8	4.49	3,830	.....	840	2.61	1,004	1.58	341	1.49	303	1.88	266
9	4.61	4,075	.....	826	2.55	952	1.54	324	1.53	320	1.53	255
10	4.62	4,096	.....	812	2.50	910	1.50	307	1.46	293	1.49	242
11	4.56	3,972	.....	798	2.48	894	1.48	300	1.78	434	2.22	228
12	4.44	3,730	.....	783	2.35	792	1.45	289	3.67*b*	426	2.82	220
13	4.41	3,670	.....	768	2.28	739	1.43	282	3.71	420	2.64	213
14	4.41	3,670	.....	753	2.23	703	1.40	271	3.83	414	2.65	209
15	4.30	3,454	.....*x*	738	2.22	695	1.38	264	4.14	407	2.74	208
16	4.10	3,084	2.26	724	2.13	634	1.40	271	3.97	401	2.75	205
17	3.95	2,825	2.29	746	2.08	602	1.47	296	3.74	395	2.55	204
18	3.86	2,673	2.42	846	2.03	571	1.49	303	3.80	387	2.60	202
19	3.73	2,462	2.43	854	1.95	524	1.49	303	3.83	380	2.65	200
20	3.58	2,228	2.38	815	1.86	475	1.47	296	3.80	374	2.53	197
21	3.45	2,035	2.38	815	1.83	460	1.48	300	3.59	367	2.39	195
22	3.38	1,934	2.33	776	1.82	454	1.49	303	3.59	361	2.42	191
23	3.25	1,752	2.30	753	1.77	430	1.50	307	3.44	354	2.53	187
24	3.18	1,656	2.25	717	1.77	430	1.46	293	3.12	347	2.50	183
25	3.06	1,498	2.20	681	1.78	434	1.46	293	3.04	338	2.49	178
26	2.99	1,408	2.25	717	1.72	405	1.45	289	2.91	332	2.54	175
27	2.82	1,209	2.25	717	1.72	405	1.47	296	2.79	322	2.60	172
28	2.73	1,117	2.19	674	1.74	415	1.50	307	2.60	318	2.53	170
29	2.66	1,050	2.15	648	1.66	378	1.49	303	2.39	312	2.26	168
30	2.56	961	2.14	641	1.64	368	1.46	293	2.28	303	2.30	167
31	2.52	927	2.13	634	.....	.....	1.46	293	.....	.....	2.37*b*	166

b-b Ice conditions.
x-x Observer sick, no gauge reading, discharge estimated.

MONTHLY DISCHARGE of Waterton river near Stand Off, for 1916

(Drainage area 740 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	230	150	199	0.269	0.31	12,236
February	2,400	184	673	0.910	0.98	38,711
March	1,000	300	673	0.910	1.05	41,381
April	1,091	713	785	1.060	1.18	46,711
May	2,479	1,091	1,708	2.310	2.66	105,020
June	10,502	2,068	4,819	6.510	7.26	286,751
July	4,922	927	2,939	3.970	4.58	180,711
August	910	634	781	1.060	1.22	48,022
September	1,041	368	647	0.874	0.98	38,499
October	359	264	309	0.418	0.48	19,000
November	434	289	347	0.468	0.52	20,648
December	297	166	220	0.297	0.34	13,527
The year	.....	.....	.....	.....	21.56	851,217

MISCELLANEOUS DISCHARGE MEASUREMENTS made in Waterton river drainage basin, in 1916

Date	Engineer	Stream	Location	Width	Area of Section	Mean Velocity	Discharge
				Feet	*Sq. ft.*	*Ft. per sec.*	*Sec.-ft.*
January 2	W. H. Storey	Blakiston brook	SE. 36-1-30-4	48	71.4	0.52	37.0
April 19	S. H. Frame	do	do	35	35.4	3.12	109.0
May 20	do	do	do	41	51.4	3.90	199.0
June 12	do	do	do	29	76.8	6.79	523.0
July 31	do	do	do	39	43.4	2.60	111.0
August 26	do	do	do	28	33.8	1.79	61.0
Sept. 14	do	do	do	28	37.6	1.97	74.0
October 5	do	do	do	24	25.4	1.44	36.0
January 1	W. H. Storey	Crooked creek *x*	SW. 16-2-29-4	17	7.7	0.92	7.0
April 20	S. H. Frame	do *x*	do	18	14.0	2.14	30.0
May 22	do	do *x*	do	19	14.2	2.22	31.0

x Supplementary to measurements of Waterton river.

BELLY RIVER DRAINAGE BASIN

General Description

Belly river rises near Chief mountain in northern Montana. The main stream is augmented on the United States side of the boundary line by Middle Fork and on the Canadian side by North Fork. From the junction with North Fork in Sec. 21, Tp. 1, Rge. 28, West of the 4th Meridian, the river flows in a winding northeasterly course until it joins the Oldman river in Sec. 27, Tp. 9, Rge. 23, West of the 4th Meridian. From this point the stream is now known as the Oldman river, although it was formerly called the Belly river, until it is joined by the Bow river and forms the South Saskatchewan river.

The topography of the basin is of the most varied character, ranging from the mountainous regions of Montana and the rolling prairie and foot-hills at the boundary to the level prairie. The upper tributaries drain a forested region; the main stream flows through a deep valley with many clumps of poplar on its banks.

There is an abundant snowfall in the upper portion of the basin, but the precipitation diminishes into semi-arid conditions near the junction with the Oldman river. At first Belly river is a comparatively clear stream but soon after crossing the boundary line it gradually becomes turbid, especially at the times of high water. The greater portion of the sediment is caused by the washing away of banks and cutting of new channels. Freshets caused by melting snow and heavy rains are frequent in the summer. The maximum flow usually occurs in June or July and after that the flow gradually decreases until it reaches the minimum in January or February.

As yet very little use has been made of the water in this basin. In the upper regions, where water could easily be diverted, it is not required for irrigation purposes and farther down stream it would be an expensive undertaking. There are, however, several small private irrigation schemes diverting water from the river.

The Alberta Railway and Irrigation Company have located and may construct a canal from Belly river to supply their irrigation system, if St. Mary river is found deficient. A survey and estimate of the cost of this proposed canal were made by the Government during 1912, and a copy of the report of this survey may be seen in the report of the Commissioner of Irrigation for 1912. There are also a number of feasible power sites in the upper regions which will no doubt be developed when there is a market.

BELLY RIVER NEAR MOUNTAIN VIEW

Location.—On the NE. ¼ Sec. 5, Tp. 2, Rge. 28, W. 4th Mer., at John West's ranch.

Records available.—November 1, 1911, to December 31, 1916.

Gauge.—Vertical staff to September 14; open chain to December 31, 1916. Zero maintained at elevation 4,544.90 feet during 1911-1916. Gauge read by J. N. West.

Bench-mark.—Permanent iron bench-mark, located on the right bank at the station, elevation 4,356.74 feet above mean sea-level (Irrigation Surveys datum).

Channel.—Permanent.

Discharge measurements.—Made from cable for all open water measurements.

Winter flow.—Winter measurements are made about 100 feet above the cable.

Accuracy.—Stage—discharge relation liable to shift during high water, otherwise permanent. Rating curve well defined between March 28 and June 13; shifting control during high water period June 13 to July 7; well defined between July 7 and October 5. Gauge read daily to hundredths

of a foot. Daily discharge ascertained by applying mean daily gauge heights to rating table; Bolster method applied between June 13 and July 7; during ice conditions applied to hydrograph mean daily gauge heights, discharge measurements and temperatures.

Remarks.—The staff gauge was replaced by chain gauge on September 15, 1916.

DISCHARGE MEASUREMENTS of Belly river near Mountain View, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 25	V. A. Newhall	45.0	66.9	0.58	1.80*b*	39
Mar. 8	do	57.0	95.1	0.68	1.90*b*	65
Mar. 28	S. H. Frame	84.0	193.0	0.97	2.05	188
April 18	do	86.0	206.0	1.30	2.27	268
May 16	do	88.0	240.0	1.53	2.49	368
May 23	do	92.0	267.0	2.00	2.79	534
June 13	do	100.0	331.0	3.24	3.57	1,073
July 7	do	102.0	364.0	3.87	3.81	1,410
July 28	do	91.0	246.0	2.31	2.82	569
Aug. 24	do	89.0	226.0	1.65	2.49	374
Sept. 12	do	88.0	202.0	1.50	2.33	303
Sept. 16	do	88.0	188.0	1.26	2.23	237
Oct. 5	do	84.0	167.0	0.83	1.94	139
Nov. 30	do	65.0	107.0	0.58	2.01*b*	64
Dec. 19	H. W. Rowley	60.0	74.0	0.93	2.01*b*	69

b Ice conditions.

DAILY GAUGE HEIGHT AND DISCHARGE of Belly river near Mountain View, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.30*b*	62	.....	36	2.14	74	2.11	203	2.61	432	2.89	595
2	2.36	52	.....	35	2.19	72	2.06	185	2.59	421	2.88	589
3	1.30	45	.....	35	2.29	71	2.10	199	2.55	399	2.93	620
4	2.30	42	.....	35	2.14	69	2.06	185	2.80	540	3.36	913
5	2.34	43	.....	34	2.14	68	2.04	178	3.04	691	3.75	1,220
6	2.40	50	.....	34	2.29	68	2.04	178	3.24	827	3.67	1,154
7	2.70	65	.....	34	2.24	67	2.04	178	3.58	1,081	3.50	1,018
8	2.70	72	.....	35	2.34	65	2.06	185	3.47	995	3.46	988
9	2.70	73	.....	36	2.10	65	2.05	181	3.11	738	3.63	1,122
10	2.39	73	.....	38	2.20	70	2.19	234	3.00	665	3.94	1,376
11	2.30	71	.....	48	2.99	110	2.20	238	2.91	607	3.85	1,302
12	2.21	60	.....	150	3.09	185	2.18	230	2.76	517	3.87	1,318
13	2.25	48	.....	340	2.99	265	2.16	222	2.64	448	3.60	1,073*s*
14	2.25	47	.....	570	2.29	281	2.30	279	2.57	410	3.90	1,346
15	2.60	49	.....	1,000	2.29	230	2.31	283	2.52	383	4.05	1,474
16	2.40	54	.....	1,000	2.28*b*	300	2.30	279	2.49	368	4.55	1,898
17	2.25	63	.....	750	2.65	454	2.29	275	2.48	363	4.70	2,018
18	2.20	71	.....*x*	480	2.12	207	2.27	266	2.49	368	4.78	2,099
19	2.20	72	2.56	200	2.13	210	2.25	258	2.57	410	5.05	2,319
20	2.20	68	2.56	145	2.18	230	2.22	246	2.76	517	5.00	2,282
21	2.36	63	2.57	125	2.17	226	2.25	258	2.81	546	5.23	2,477
22	2.30	56	2.22	114	2.13	210	2.22	246	2.83	558	4.44	1,840
23	2.20	48	2.22	103	2.10	199	2.18	230	2.79	534	3.96	1,450
24	.....	43	2.22	95	2.12	207	2.20	238	2.79	534	3.90	1,404
25	1.80	39	2.22	88	2.11	203	2.15	218	2.81	546	3.89	1,402
26	.....*x*	36	2.23	83	2.01	167	2.20	238	2.87	582	3.95	1,457
27	.....	35	2.18	78	2.05	181	2.38	315	2.90	601	4.15	1,630
28	.....	35	2.23	77	2.05	181	2.55	399	2.97	646	4.65	2,049
29	.....	35	2.13	76	2.15	218	2.58	415	2.96	639	4.70	2,096
30	.....	36	.....	.....	2.14	214	2.57	410	2.94	627	4.38	1,838
31	.....*x*	36	.....	.....	2.12	207	.....	.....	2.91	607	.....	.....

b-b Ice conditions; discharge taken from winter hydrograph
x-x River frozen to bottom at gauge, no readings.
s Shifting conditions, June 13 to July 7.

DAILY GAUGE HEIGHT AND DISCHARGE of Belly river near Mountain View, for 1916—*Concluded*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-f*
1	4.16	1,662	2.76	530	2.49	374	2.00	164	1.96	150	.....	64
2	4.19	1,692	2.75	524	2.45	353	2.01	167	1.99	161	1.97	63
3	4.19	1,698	2.73	512	2.53	395	2.02	171	2.02	171	1.89	65
4	4.21	1,720	2.74	518	3.03	724	1.98	157	2.01	166	1.85	67
5	4.01	1,564	2.75	524	2.96	670	1.94	144	1.99	161	1.96	67
6	3.81	1,404	2.66	469	2.92	640	1.94	144	2.00	164	2.03	66
7	3.81	1,410e	2.61	440	2.76	530	1.95	147	1.95	147	1.78	64
8	3.89	1,841	2.67	475	2.72	505	1.91	134	1.94	144	1.94	59
9	3.96	1,544	3.00	700	2.60	434	1.86	119	2.19*b*	135	2.07	58
10	4.07	1,643	2.95	662	2.50	379	1.84	113	2.20	128	2.15	59
11	4.06	1,634	2.92	640	2.41	333	1.88	125	2.19	122	2.14	62
12	3.90	1,490	2.86	597	2.33	295	1.90	131	2.22	119	2.14	63
13	3.92	1,508	2.82	570	2.28	272	1.90	131	2.24	118	2.10	64
14	3.95	1,535	2.78	543	2.25	259	1.92	137	2.24	117	2.08	66
15	3.57	1,193	2.65	463	2.24	255	1.90	131	2.14	115	2.06	67
16	3.54	1,166	2.65	463	2.23	251	1.89	128	2.06	110	2.07	68
17	3.51	1,139	2.69	487	2.22	246	1.91	134	2.07	105	2.05	68
18	3.50	1,130	2.73	512	2.25	259	1.94	144	2.02	100	2.04	69
19	3.45	1,085	2.74	518	2.22	246	1.94	144	1.98	94	2.01	69
20	3.20	863	2.66	469	2.15	218	1.91	134	2.00	85	2.03	68
21	3.10	780	2.59	428	2.15	218	1.92	137	1.97	76	2.16	65
22	3.09	772	2.53	395	2.15	218	1.90	131	1.95	69	2.18	62
23	3.09	772	2.51	384	2.10	199	1.91	134	1.86	64	2.25	58
24	3.13	805	2.49	374	2.14	214	1.91	134	1.83	60	2.23	54
25	2.96	670	2.44	348	2.11	203	1.90	131	1.82	57	2.20	52
26	3.00	700	2.45	353	2.10	199	1.89	128	1.86	56	2.19	51
27	2.87	604	2.55	406	2.09	195	1.92	137	1.88	57	2.20	51
28	2.88	611	2.52	390	2.08	192	2.00	164	.....	58	2.11	52
29	2.77	537	2.52	390	2.05	181	1.98	157	.....	62	2.10	56
30	2.75	524	2.50	379	2.03	174	1.99	161	2.01	64	2.15	60
31	2.75	524	2.47	363	.....	.....	2.00	164	.....	.....	2.11*b*	65

b-b Ice conditions.
e Discharge estimated.

MONTHLY DISCHARGE of Belly river near Mountain View, for 1916

(Drainage area 121 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	73	35	53	0.438	0.50	3,259
February	1,000	34	203	1.680	1.81	11,677
March	454	65	173	1.430	1.65	10,637
April	415	178	248	2.050	2.29	14,757
May	1,081	363	568	4.690	5.41	34,925
June	2,477	589	1,479	12.220	13.63	88,007
July	1,720	524	1,157	9.560	11.02	71,141
August	700	348	478	3.950	4.55	29,391
September	724	174	321	2.650	2.96	19,101
October	171	113	141	1.170	1.35	8,670
November	171	56	108	0.893	1.00	6,426
December	69	51	62	0.512	0.59	3,812
The year	.....	.....	.....	.....	46.76	301,803

MEAN MONTHLY DISCHARGE in Second-feet of Belly river near Mountain View

MONTH	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	160	209	383	325	141	244	14,978
November	143	137	159	272	196	108	169	10,065
December	89	87	84	113	97	62	89	5,458
January	90	66	78	72	53	.....	72	4,420
February	47	53	65	56	203	.....	85	4,811
March	51	53	65	51	173	.....	79	4,487
April	203	227	253	262	248	.....	239	14,198
May	662	680	797	609	568	.....	663	40,973
June	718	1,428	868	934	1,479	.....	1,085	64,590
July	512	632	535	608	1,157	.....	689	43,087
Aug.	289	392	284	376	478	.....	364	22,370
September	177	194	232	334	321	.....	252	14,970
Total in acre-ft.	182,623	249,395	219,754	246,346	320,524	.....	.....	244,407

MAMI CREEK AT MOUNTAIN VIEW

Location.—On the SE. ¼ Sec. 19, Tp. 2, Rge. 27, W. 4th Mer.

Records available.—August 13, 1909, to October 31, 1916.

Gauge.—Vertical staff on bridge pier. Zero of gauge maintained at elevation 93.06 during 1909-1916.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—Composed of stones covered with sand and gravel; not liable to shift, except in high floods.

Discharge measurements.—Made with current-meter by wading, during low water and from highway bridge at high stages.

Winter flow.—Records are discontinued during winter season.

Observer.—C. H. Findlay.

DISCHARGE MEASUREMENTS of Mami creek at Mountain View, in 1916

Date	Hydrographer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 11	V. A. Newhall	.....	.....	.....	2.85*c*	0.0*x*
Mar. 27	S. H. Frame	21.0	12.00	2.25	1.97	27.0
Mar. 31	do	21.0	12.00	2.08	1.95	25.0
April 17	do	20.0	11.80	1.93	1.94	23.0
April 21	do	19.5	11.10	1.61	1.85	17.9
May 15	do	20.0	12.00	1.92	1.91	23.0
May 23	do	20.0	11.00	1.73	1.83	18.9
June 13	do	23.0	20.00	3.16	2.22	63.0
July 7	do	20.0	13.10	2.81	2.07	37.0
July 28	do	13.0	5.60	1.61	1.76	9.0
Aug. 24	do	12.0	4.30	0.95	1.68	4.1
Sept. 12	do	11.0	4.00	0.82	1.64	3.3
Sept. 16	do	11.0	3.80	0.92	1.65	3.5
Oct. 4	do	10.0	3.60	1.36	1.70	4.9*i*
Oct. 7	do	11.0	4.40	1.41	1.70*c*	6.2

x No measurement, stream frozen over; discharge very small.
c Gauge height affected by backwater from ice.
i Stream frozen over.

DAILY GAUGE HEIGHT AND DISCHARGE of Mami creek at Mountain View, for 1916

DAY	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	2.20	60.0	1.98	29.0	2.30	79.0
2	.....	.....	2.05	37.0	2.20	60.0	2.25	69.0
3	.....	.....	2.05	37.0	2.00	31.0	2.20	60.0
4	.....	.....	2.05	37.0	1.98	29.0	2.20	60.0
5	.....	.....	1.99	30.0	1.97	27.0	2.35	89.0
6	.....	.....	2.00	31.0	1.97	27.0	2.35	89.0
7	.....	.....	2.05	37.0	1.95	25.0	2.30	79.0
8	.....	.....	2.05	37.0	1.92	22.0	2.23	65.0
9	4.57	180.0*e*	2.05	37.0	1.89	19.7	2.20	60.0
10	4.57	180.0*e*	2.00	31.0	1.86	17.1	2.35	89.0
11	3.97	120.0*e*	1.98	29.0	1.82	13.9	2.50	119.0
12	2.35	87.0*e*	1.98	29.0	1.92	22.0	2.40	99.0
13	2.31	85.0*e*	1.95	25.0	1.92	22.0	2.22	63.0
14	2.26	60.0*e*	1.95	25.0	1.90	20.6	2.27	73.0
15	2.19	55.0*e*	1.98	29.0	1.88	18.8	2.20	59.0
16	2.15	51.0	1.95	25.0	2.00	31.0	2.15	50.0
17	2.10	44.0	1.94	24.0	1.95	25.0	2.10	41.0
18	.....	40.0*e*	1.95	25.0	1.87	18.0	1.08	0.16
19	2.05	37.0	1.93	23.0	1.87	18.0	1.10	0.20
20	2.10	44.0	1.97	27.0	1.83	14.6	1.10	0.20
21	2.10	44.0	1.85	16.2	1.90	21.0	1.30	0.60
22	2.00	31.0	1.91	22.0	1.78	11.0	1.15	0.30
23	1.95	25.0	1.90	21.0	1.98	29.0	1.10	0.20
24	1.90	21.0	1.88	18.8	2.08	41.0	1.00	0.00
25	1.85	16.2	1.84	15.4	2.28	75.0	1.15	0.30
26	1.85	16.2	1.84	15.4	2.33	85.0	1.30	0.60
27	1.97	27.0	1.84	15.4	2.69	157.0	1.10	0.20
28	1.85	16.2	1.89	19.7	2.39	97.0	2.15	50.00
29	1.85	16.2	1.93	23.0	2.50	119.0	2.10	41.00
30	2.01	32.0	1.95	25.0	2.40	99.0	2.10	41.00
31	1.95	25.0	.....	.....	2.30	79.0	.....	.....

e Discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of Mami creek at Mountain View, for 1916—*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.10	41.0	1.73	6.5	1.67	4.0	1.59	2.5
2	3.10	239.0	1.72	6.0	1.67	4.0	1.59	2.5
3	3.00	219.0	1.72	6.0	1.70	4.9	1.70	4.9
4	2.60	139.0	1.72	6.0	1.85	14.6	1.70	4.9*i*
5	2.20	59.0	1.72	6.0	1.80	10.9	1.70	4.9
6	2.15	50.0	1.71	5.4	1.78	9.6	1.76	8.3
7	2.07	37.0	1.70	4.9	1.76	8.3	1.70	4.9*c*
8	2.07	37.0	1.70	4.9	1.75	7.6	1.75	7.6
9	2.05	34.0	1.85	14.6	1.73	6.5	1.75	7.6
10	2.00	28.0	1.95	23.2	1.70	4.9	1.75	7.6
11	1.95	23.0	1.90	18.6	1.67	4.0	1.75	7.6
12	1.93	21.0	1.80	10.9	1.64	3.2	1.74	7.1
13	1.90	18.6	1.75	7.6	1.64	3.2	1.74	7.1
14	1.88	17.0	1.70	4.9	1.62	2.9	1.72	6.0
15	1.85	14.6	1.70	4.9	1.61	2.8	1.72	6.0
16	1.83	13.1	1.70	4.9	1.65	3.4	1.72	6.0
17	1.83	13.1	1.70	4.9	1.59	2.5	1.70	4.9
18	1.84	13.9	1.70	4.9	1.59	2.5	1.70	4.9
19	1.84	13.9	1.70	4.9	1.59	2.5	1.70	4.9
20	1.84	13.9	1.70	4.9	1.59	2.5	1.74	7.1
21	1.82	12.4	1.70	4.9	1.59	2.5	1.74	7.1
22	1.82	12.4	1.70	4.9	1.59	2.5	1.75	7.6
23	1.83	13.1	1.70	4.9	1.59	2.5	1.75	7.6
24	1.83	13.1	1.68	4.3	1.59	2.5	1.74	7.1
25	1.83	13.1	1.66	3.7	1.59	2.5	1.72	6.0
26	1.83	13.1	1.67	4.0	1.59	2.5	1.71	5.4
27	1.86	15.4	1.67	4.0	1.59	2.5	1.70	4.9
28	1.76	8.3	1.67	4.0	1.59	2.5	1.70	4.9
29	1.78	9.6	1.67	4.0	1.59	2.5	1.70	4.9
30	1.78	9.6	1.67	4.0	1.59	2.5	1.70	4.9
31	1.76	8.3	1.67	4.0	.....	.....	1.70	4.9

c Gauge height affected by backwater from ice.
i Stream frozen over.

MONTHLY DISCHARGE of Mami creek at Mountain View, for 1916

(Drainage area 22 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (9-31)	180.0	16.20	54.0	2.450	2.08	2,463
April	60.0	15.40	28.0	1.270	1.42	1,666
May	157.0	11.00	42.0	1.910	2.20	2,582
June	119.0	0.16	46.0	2.090	2.33	2,737
July	239.0	8.30	38.0	1.730	1.99	2,336
August	23.2	3.70	6.5	0.295	0.34	400
September	14.6	2.50	4.3	0.195	0.22	256
October	8.3	4.90	5.9	0.268	0.31	363
The period	.....	.....	.....	.....	10.89	12,803

MEAN MONTHLY DISCHARGE in Second-feet, of Mami creek at Mountain View

MONTH	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	3.60	.....	3.30	1.30	5.2	25.0	5.9	7.4	454
November	.....	.....	.....	2.20*e*	.....	.....	.....	.....		
December	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
March	.....	.....	.....	.....	.....	36.0*c*	54.0*d*	.....	.....	.....
April	4.10	*m*	18.50	24.00*a*	9.60*b*	12.3	28.0	.....	15.7	936
May	7.00	.....	11.70	15.70	12.10	27.0	42.0	.....	19.2	1,187
June	3.00	.....	4.30	5.20	5.70	104.0	46.0	.....	28.0	1,673
July	0.20	.....	4.10	2.30	2.40	42.0	38.0	.....	14.8	913
August	Nil	.....	3.40	1.51	0.97	28.0	6.5	.....	6.7	414
September	2.80	.....	1.04	1.05	1.38	17.0	4.3	.....	4.6	273
Total in acre-ft.	1,033	221	2,598	2,638	1,719	14,562	13,977	.....	.....	5,850

a 15-30.
b 17-30.
m No observer in 1911.
c 28-31.
d 9-31.
e 1-15.

CHRISTIANSON DITCH NEAR MOUNTAIN VIEW

Location.—On the SE. ¼ Sec. 12, Tp. 3, Rge. 28, W. 4th Mer.
Records available.—May 17 to July 1, 1913.
Gauge.—Vertical staff; elevation of zero 96.04 feet. Gauge not read during 1914-16.
Bench-mark.—Wooden stake in left bank assumed elevation 100.00 feet.
Channel.—Permanent.
Discharge measurements.—Made by weir or current-meter.
Remarks.—One discharge measurement only in 1914. Ditch not used during 1915-16.

BELLY RIVER NEAR STAND OFF

Location.—On the NE. ¼ Sec. 16, Tp. 6, Rge. 25, W. 4th Mer., near Stand Off.
Records available.—May 27, 1909, to December 31, 1916.
Gauge.—Chain gauge on bridge January 1 to February 15; zero at 90.82 feet.
Vertical staff February 22 to November 27; zero at 91.09 feet.
Box chain gauge at bridge site November 28 to December 31; zero 90.81 feet.
For information prior to 1916 see previous reports.
Gauge read by Thomas Graham.
Bench-marks.—Permanent iron bench-mark; assumed elevation 100.00 feet.
Channel.—Composed of clean gravel and small stones, not liable to shift.
Discharge measurements.—Made with current-meter by wading at low stages and from cable at high stages.
Winter flow.—Measurements through the ice are made at a point two hundred feet above new chain gauge.
Accuracy.—Stage discharge relation practically permanent; not altered by ice during year. Rating table well defined between zero flow and 3,200 second-feet. Gauge read daily, except for short periods, to one one-hundredth of a foot.
Daily discharge ascertained by applying mean daily gauge heights to rating table, results good; Bolster method used from April 3 to June 15; during ice conditions applied to hydrograph mean daily gauge heights, discharge measurements and temperatures.
Remarks.—The high floods of February 16, 1916, carried away the highway bridge and destroyed the gauging station. The station was re-established February 22. A box chain gauge was installed November 28.

Discharge Measurements of Belly river near Stand Off, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 17	W. H. Storey	85.5	63.9	1.16	2.12*bx*	74
April 3	S. H. Frame	105.0	135.0	3.06	1.64	413
May 5	do	92.0	202.0	3.17	2.11	640
June 15	do	97.0	315.0	4.60	3.27	1,450
June 25	W. A. Burton	98.0	315.0	4.75	3.31	1,496
June 26	do	99.0	321.0	4.92	3.42	1,580
June 27	do	99.0	339.0	5.04	3.56	1,707
June 28	do	153.0	595 0	5.48	5.56	3,262
July 14	S. H. Frame	98.0	314.0	4.62	3.27	1,451
Aug. 3	do	93.0	188.0	2.71	1.97	511
Sept. 1	W. A. Burton	90.0	160.0	2.24	1.67	358
Sept. 22	S. H. Frame	89.0	131.0	1.56	1.26	205
Nov. 28	H. W. Rowley	66.0	62.1	1.84	1.21*b*	114
Dec. 15	do	57.0	50.1	1.10	1.33*b*	95

b Ice conditions.
x Temporary gauge on bridge.

Daily Gauge Height and Discharge of Belly river near Stand Off, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	....*b*	47	1.92	92	0.95	125	2.07	575	1.85	486	2.75	1,086
2	.....	49	2.01	100	0.97	129	2.02	545	1.96	551	2.55	935
3	.....	51	2.02	105	1.30	218	1.64	413*s*	1.84	474	2.18	672
4	.....	52	2.09	108	1.30	218	1.55	370	1.92	521	2.50	891
5	.....	53	2.14	111	1.24	199	1.40	307	2.11	639	2.75	1,078
6	.....	54	2.14	111	1.20	187	1.38	296	2.40	840	3.20	1,431
7	.....	55	2.31	110	1.00	136	1.38	296	2.63	1,009	3.11	1,360
8	.....	56	2.38	110	1.05	147	1.37	288	2.80	1,141	2.90	1,188
9	.....	56	2.30	110	2.69	400	1.39	296	2.60	987	3.00	1,266
10	.....	58	2.34	111	.....	600*e*	1.40	296	2.35	804	3.26	1,470
11	.....	60	2.10	115	.....	650*e*	1.47	323	2.15	672	3.54	1,683
12	.....	64	2.11	120	.....	600*e*	1.49	331	2.04	600	3.24	1,446
13	.....	66	2.14	125	.....	450*e*	1.43	307	1.95	545	3.10	1,336
14	.....	68	2.24	131	.....	400*e*	1.53	344	1.80	457	3.18*a*	1,391*s*
15	.....	70	2.26*b*	140	.....	380*e*	1.56	357	1.76	434	3.27	1,462
16	....*b*	72	.....	1,200*eg*	.....	420*e*	1.51	335	1.74	423	3.95	1,997
17	2.12	74	.....	1,750*e*	.....	440*e*	1.49	323	1.69	398	4.30	2,272
18	2.12	68	9.01	1,500*e*	.....	460*e*	1.46	311	1.71	408	4.40	2,350
19	2.10	64	.....	1,000*e*	.....	500*e*	1.44	303	1.72	413	4.64	2,539
20	2.09	58	.....	600*e*	.....	480*e*	1.41	292	1.77	440	4.80	2,665
21	2.09	53	.....	400*e*	.....	500*e*	1.42	296	1.79	451	5.00	2,822
22	1.93	48	2.05	360	2.54	600	1.44	299	1.91	521	4.45	2,390
23	1.82	45	1.90	340	.....	677*e*	1.40	284	2.06	607	3.85	1,918
24	1.66	44	1.72	320	.....	456*e*	1.33	259	2.21	706	3.51	1,651
25	1.65	46	1.80	300	1.35	235	1.31	252	2.94	1,250	3.31	1,494
26	1.73	52	1.74	300	1.32	225	1.34	259	3.71	1,063	3.41	1,572
27	1.75	57	1.49	284	1.34	232	1.41	284	2.87	1,188	3.58	1,705
28	1.78	63	1.60	327	1.37	242	1.68	398	2.61	987	5.60	3,294
29	1.83	70	1.25	202	1.36	238	1.70	408	2.55	942	5.35	3,097
30	1.84	76	.....	.....	1.36	238	1.81	468	2.95	1,250	.....	2,566*e*
31	1.84	84	.....	.....	1.35	235	.....	.....	2.64	1,002	.....	.....

a Gauge height interpolated.
b–b Ice conditions.
e Discharge estimated.
g Ice going out.
s–s Shifting conditions.

Monthly Discharge of Belly river near Stand Off, for 1915

(Drainage area 461 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	82	55	67	0.145	0.17	4,120
February	62	54	57	0.124	0.13	3,166
March	200	49	100	0.217	0.25	6,149
April	514	154	274	0.594	0.66	16,304
May	1,231	413	679	1.472	1.70	41,750
June	2,700	570	1,401	3.039	3.39	83,305
July	1,939	442	870	1.887	2.18	53,494
August	2,100	302	578	1.254	1.44	35,540
September	1,210	302	452	0.980	1.09	26,896
October	681	333	437	0.948	1.09	26,870
November	328	153	244	0.529	0.59	14,519
December	141	45	81	0.176	0.20	4,980
The year					12.89	317,093

This table is inserted in this report to correct a table which was published on page 267 of the report for 1915. The total run-off in acre-feet for the month of April was incorrect, but the balance of the table, as then published, was correct.

DAILY GAUGE HEIGHT AND DISCHARGE of Belly river near Stand Off, for 1916.—*Concluded.*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.00	2,036	1.95	503	1.65	348	1.19	184	1.13	167	1.15	106
2	4.84	2,696	1.93	491	1.65	348	1.19	184	1.13	167	1.19	104
3	4.61	2,516	1.96	509	1.74	388	1.19	184	1.15	173	1.23	100
4	4.04	2,067	1.96	509	2.03	551	1.18	181	1.15	173	1.23	98
5	3.64	1,753	1.91	480	2.30	726	1.15	173	1.15	173	1.11	96
6	3.46	1,611	1.87	457	2.19	652	1.16	176	1.13	167	1.19	95
7	3.37	1,542	1.84	440	2.08	582	1.18	181	1.08	154	1.09	95
8	3.38	1,548	1.88	462	1.95	503	1.09	157	1.07	152	1.09	94
9	3.43	1,588	2.12	607	1.91	480	1.08	154	1.06	149	1.10	93
10	3.51	1,651	2.29	719	1.83	434	1.07	152	1.03	143	1.08	93
11	3.47	1,620	2.23	679	1.73	384	1.07	152	0.89	112	1.10	93
12	3.34	1,517	2.09	588	1.59	323	1.07	152	0.89	112	1.15	94
13	3.25	1,446	1.99	527	1.53	299	1.06	149	0.92	118	1.32	94
14	3.27	1,462	1.93	491	1.46	274	1.07	152	0.96*b*	119	1.32	95
15	3.03	1,274	1.90	474	1.44	266	1.06	149	0.94	119	1.32	95
16	2.86	1,141	1.85	445	1.40	252	1.05	147	1.10	119	1.36	94
17	2.83	1,117	1.87	457	1.39	249	1.09	157	1.51	119	1.37	91
18	2.85	1,133	1.96	509	1.34	232	1.13	167	1.50	118	1.27	88
19	2.67	994	1.98	521	1.30	218	1.09	157	1.45	118	1.31	86
20	2.53	891	1.92	486	1.29	215	1.09	157	1.25	118	1.38	84
21	2.42	811	1.83	434	1.29	215	1.11	162	1.17	118	1.31	81
22	2.37	775	1.78	408	1.26	205	1.18	181	1.40	118	1.36	78
23	2.37	775	1.77	403	1.27	208	1.14	170	1.31	118	1.49	76
24	2.32	740	1.69	366	1.24	199	1.12	166	1.17	118	1.55	73
25	2.25	692	1.70	370	1.23	196	1.09	157	1.08	118	1.52	71
26	2.18	646	1.72	379	1.22	193	1.09	157	1.18	117	1.47	68
27	2.17	639	1.76	398	1.20	187	1.13	167	1.18	116	1.42	66
28	2.09	588	1.74	388	1.19	184	1.18	181	1.05	114	2.04	64
29	2.05	563	1.71	375	1.19	184	1.17	179	1.09	112	1.87	61
30	2.02	545	1.68	361	1.19	184	1.15	173	1.11	109	1.85	60
31	1.98	521	1.67	357	.....	.....	1.13	167	.....	.....	1.72*b*	60

b-b Ice conditions, November 14 to December 31.

MONTHLY DISCHARGE of Belly river near Stand Off, for 1916

(Drainage area 461 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	84	44	59	0.128	0.15	3,628
February	1,750	92	365	0.792	0.85	20,995
March	677	125	355	0.770	0.89	21,828
April	575	252	337	0.731	0.82	20,053
May	1,250	398	716	1.553	1.79	44,025
June	3,294	672	1,768	3.835	4.28	105,203
July	2,696	521	1,255	2.722	3.14	77,167
August	719	357	471	1.021	1.18	28,960
September	726	184	323	0.701	0.78	19,220
October	184	147	165	0.358	0.41	10,145
November	173	109	132	0.286	0.32	7,855
December	106	60	85	0.184	0.21	5,226
The year	.....	.....	.....	.....	14.82	364,305

MEAN MONTHLY DISCHARGE in Second-feet of Belly river near Stand Off

MONTH	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	189	494	266	227	204	450	437	165	304	18,698
November	.....	.....	.....	128*c*	249	156	251	244	132	206	12,282
December	.....	.....	.....	127*d*	.....	128	78	81	85	93	5,718
January	.....	.....	61	78	56	93	67	59	.....	69	4,244
February	.....	.....	88	75	67	50	57	365	.....	117	6,647
March	.....	.....	394*b*	57*e*	81	98	100	355	.....	158	9,741
April	.....	788	298	297*f*	427	357	274	337	.....	414	24,602
May	2,087*a*	852	1,043	860	810	872	679	716	.....	833	51,222
June	2,519	682	1,454	851	1,391	888	1,401	1,768	.....	1,369	81,467
July	1,134	439	641	675	706	571	870	1,255	.....	786	48,264
August	608	220	534	321	457	320	578	471	.....	439	26,975
September	268	411	955	171	186	256	452	323	.....	378	22,475
Total in Acre-feet	297,779	216,448	356,784	217,237	281,491	241,935	318,125	387,448	.....	.....	312,335

a 26-31.
b 1-18 and 24-31.
c 1-4 and 27-30.
d 1-13.
e 1-24.
16-30.

ST. MARY RIVER DRAINAGE BASIN

General Description

St. Mary river, an important tributary of the Oldman river, and thus indirectly of the South Saskatchewan river, heads in northern Montana on the eastern slope of the main range of the Rocky mountains. It starts from the great Blackfoot glacier and receives affluents from numerous lesser glaciers. These streams unite within a short distance from their source and flow into Upper St. Mary lake. Below this lake and in close proximity, is lower St. Mary lake, the aggregate lengths of the two being about 22 miles. The river flows out of the lower lake, at an elevation of 4,460 feet above mean sea-level, and takes a northerly course through the foot-hills to the international boundary. From the boundary it flows in a north and easterly direction, through a rolling country, finally emptying into the Oldman river near Lethbridge, Alberta.

The basin is bounded on the south by the Rocky mountains, on the west by the watershed between Belly and St. Mary rivers and on the east by the watershed between Milk and St. Mary rivers. The upper portion of the basin is heavily timbered and receives its precipitation mostly in the shape of snowfall; the lower and major portion is totally devoid of tree growth and has a small precipitation.

The river flows through a very deep valley having steep banks, making the diversion of water from this stream for irrigation, an expensive undertaking. In Canada the Alberta Railway and Irrigation Company has water rights on this river. The headgate of their canal is at Kimball, five miles north of the boundary, and they already have many miles of ditch constructed, which irrigates land surrounding Lethbridge.

As this is an international river, discharge measurements are taken on it by both the Canadian and American Governments. The engineers of both countries use a common gauging station near Kimball.

FIDLER BROTHERS DITCH FROM BOUNDARY CREEK

Location.—On the SE. ¼ Sec. 19, Tp. 1, Rge. 26, W. 4th Mer.
Records available.—September 13, 1911, to July 13, 1914.
Gauge.—Vertical staff; zero of gauge 96.10 feet. Gauge not read during 1915-16.
Bench-marks.—Wooden plug on the left bank, eight feet west of the gauge; assumed elevation 100.00 feet.
Channel.—Permanent.
Discharge measurements.—Made by current-meter.
Observer.—Jas. Fidler.
Remarks.—Ditch not used during 1915 and 1916.

BOUNDARY CREEK AT FIDLER BROTHERS' RANCH

Location.—On the SW. ¼ Sec. 20, Tp. 1, Rge. 26, W. 4th Mer.

Records available.—June 18, 1913, to October 31, 1916.

Gauge.—Vertical staff. Zero of gauge maintained at 96.98 feet during 1913. Zero of gauge maintained at 95.06 feet during 1914-16.

Bench-mark.—Permanent iron bench-mark located 25 feet from edge of left bank and 20 feet down stream from the gauge; assumed elevation 100.00 feet.

Channel.—Consists of fine gravel, stone and clay; not liable to shift.

Discharge measurements.—Made with current-meter, at low stages by wading and from temporary foot-bridge at higher stages.

Winter flow.—Records have not been obtained during the winter season.

Observer.—James Fidler.

DISCHARGE MEASUREMENTS of Boundary creek at Fidler Brothers' ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 15	S. H. Frame	16.0	17.3	1.82	1.78	32.0
May 13	do	16.0	18.9	1.69	1.78	32.0
June 17	do	17.0	20.5	1.94	1.96	40.0
July 21	do	16.0	13.8	1.14	1.65	18.7
Aug. 22	do	15.0	11.8	0.98	1.49	11.6
Sept. 25	do	15.0	10.6	0.62	1.40	6.6

DAILY GAUGE HEIGHT AND DISCHARGE of Boundary creek at Fidler Brothers' ranch, for 1916

Day	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			1.85	34.0	1.72	23	2.28	79
2			1.87	35.0	1.74	25	2.28	79
3			1.85	34.0	1.76	26	2.22	72
4			1.83	32.0	1.76	26	2.20	70
5			1.81	30.0	1.77	27	2.26	77
6			1.82	31.0	1.78	28	2.28	79
7			1.81	30.0	1.78	28	2.26	77
8			1.79	29.0	1.76	26	2.22	72
9			1.78	28.0	1.75	26	2.24	74
10			1.77	27.0	1.74	25	2.27	78
11			1.76	26.0	1.72	23	2.29	80
12			1.75	26.0	1.74	25	2.24	74
13			1.75	26.0	1.78	28	2.09	58
14			1.77	27.0	1.80	30	2.06	54
15			1.78	28.0	1.82	31	2.01	49
16			1.72	23.0	1.83	32	1.96	44
17			1.71	23.0	1.82	31	1.96	44
18			1.70	22.0	1.81	30	1.89	37
19			1.69	21.0	1.79	29	1.92	40
20			1.68	21.0	1.78	28	1.95	43
21			1.67	20.0	1.79	29	2.02	50
22			1.66	19.4	1.82	31	2.01	49
23			1.66	19.4	1.84	33	1.99	47
24			1.66	19.4	1.87	35	1.95	43
25			1.68	21.0	1.90	38	1.91	39
26			1.68	21.0	1.93	41	1.98	46
27	1.97	45	1.69	21.0	1.96	44	2.13	62
28	1.95	43	1.70	22.0	1.99	47	2.13	62
29	1.93	41	1.71	23.0	2.05	53	2.17	67
30	1.89	37	1.72	23.0	2.09	58	2.16	66
31	1.86	35			2.18	68		

DAILY GAUGE HEIGHT AND DISCHARGE of Boundary creek at Fidler Brothers' ranch, for 1916 —*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.06	54.0	1.57	14.4	1.44	8.5	1.48	10.1
2	2.04	52.0	1.55	13.4	1.44	8.5	1.49	10.5
3	1.99	47.0	1.54	12.9	1.47	9.7	1.53	12.4
4	1.94	42.0	1.52	12.0	1.50	11.0	1.56	13.9
5	1.89	37.0	1.50	11.0	1.53	12.4	1.58	15.0
6	1.86	34.0	1.49	10.5	1.54	12.9	1.55	13.4
7	1.85	34.0	1.48	10.1	1.56	13.9	1.55	13.4
8	1.84	33.0	1.47	9.7	1.56	13.9	1.54	12.9
9	1.84	33.0	1.51	11.5	1.57	14.4	1.53	12.4
10	1.84	33.0	1.55	13.4	1.56	13.9	1.52	12.0
11	1.80	30.0	1.59	15.5	1.54	12.9	1.52	12.0
12	1.78	28.0	1.63	17.6	1.56	13.9	1.51	11.5
13	1.76	26.0	1.66	19.4	1.58	15.0	1.52	12.0
14	1.73	24.0	1.64	18.2	1.58	15.0	1.54	12.9
15	1.70	22.0	1.61	16.5	1.56	13.9	1.54	12.9
16	1.69	21.0	1.58	15.0	1.56	13.9	1.56	13.9
17	1.70	22.0	1.56	13.9	1.54	12.9	1.56	13.9
18	1.72	23.0	1.60	16.0	1.52	12.0	1.58	15.0
19	1.70	22.0	1.62	17.1	1.50	11.0	1.58	15.0
20	1.68	21.0	1.53	12.4	1.48	10.1	1.60	16.0
21	1.65	18.7	1.50	11.0	1.45	8.9	1.62	17.1
22	1.64	18.2	1.49	10.5	1.44	8.5	1.62	17.1
23	1.63	17.6	1.48	10.1	1.43	8.2	1.64	18.2
24	1.62	17.1	1.46	9.3	1.42	7.8	1.64	18.2
25	1.60	16.0	1.46	9.3	1.40	7.1	1.60	16.0
26	1.61	16.5	1.45	8.9	1.44	8.5	1.56	13.9
27	1.62	17.1	1.44	8.5	1.45	8.9	1.56	13.9
28	1.64	18.2	1.44	8.5	1.44	8.5	1.57	14.4
29	1.62	17.1	1.42	7.8	1.46	9.3	1.56	13.9
30	1.60	16.0	1.42	7.8	1.47	9.7	1.56	13.9
31	1.59	15.5	1.42	7.8	.....	.....	1.55	13.4

MONTHLY DISCHARGE of Boundary creek at Fidler Brothers' ranch, for 1916

(Drainage area 44 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (27-31)	45.0	35.0	40.0	0.909	0.17	397
April	35.0	19.4	25.0	0.568	0.63	1,488
May	68.0	23.0	33.0	0.750	0.86	2,029
June	80.0	37.0	60.0	1.360	1.52	3,570
July	54.0	15.5	27.0	0.614	0.71	1,660
August	19.4	7.8	12.3	0.280	0.32	756
September	15.0	7.1	11.2	0.255	0.28	666
October	18.2	10.1	14.0	0.318	0.37	861
The period	.....	.....	.....	.....	4.86	11,427

MEAN MONTHLY DISCHARGE of Boundary creek at Fidler Brothers' ranch

Area of watershed 44 square miles
Average run-off per square mile 234.9 acre-feet

YEAR	Mar. Sec.-ft.	April Sec.-ft.	May Sec.-ft.	June Sec.-ft.	July Sec.-ft.	Aug. Sec.-ft.	Sept. Sec.-ft.	Oct. Sec.-ft.	Nov. Sec.-ft.	Total Acre-ft.
1913	.....	.....	.....	*22a*	13	11	9	10	9	*3,742a*
1914	.....	14	17	9	4	3	4	12	.....	3,798
1915	*17a*	16	28	88	55	29	25	25	.....	16,534
1916	*40a*	25	33	60	27	12	11	14	.....	11,427
Average sec.-ft.	.....	18	26	52	25	14	12	15	9	10,586
Average acre-ft.	.....	1,071	1,599	3,094	1,537	861	714	922	536	10,334

a Records incomplete, not included in average.

ST. MARY RIVER NEAR KIMBALL

Location.—On the NW. ¼ Sec. 25, Tp. 1, Rge. 25, W. 4th Mer., one mile above the Alberta Railway and Irrigation Company's dam.

Records available.—April 13, 1908, to November 31, 1916.

Gauges.—Stevens continuous water stage recorder, housed in a concrete shelter, about 3,000 feet above the cable installed in 1912; zero of which has been maintained at 88.75 feet, determined on November 17, to be 3,903.38 feet above mean sea-level.

Vertical staff at cable, the zero of staff which has been maintained at 85.84 feet during 1914-1916, determined on November 10 to be 3,904.24 feet above mean sea-level.

Chain gauge located on the bridge on the SW. ¼ Sec. 1, Tp. 2, Rge. 25, W. 4th Mer., zero of which was maintained at 86.97 feet during 1914-15.

The vertical staff at cable, and the chain gauge at the bridge, were read by J. M. Dunn.

Bench-marks.—For automatic gauge; a spike on the downstream side of the concrete shelter; assumed elevation 100.00 feet was, on November 17, found to be 3,914.63 feet above mean sea-level.

For staff gauge at cable, a permanent iron bench-mark, formerly assumed elevation of 100.00 feet, by irrigation surveys, has an elevation 3,904.24 feet above mean sea-level.

For chain gauge a permanent iron bench-mark; assumed elevation 100.00 feet; located 131 feet northeast of the right abutment of the bridge.

Channel.—Consists of sand and gravel. High waters created a shifting control during most of year, the greatest change occurring in June.

Discharge measurements.—Made from cable car on NE. ¼ Sec. 25, Tp. 1, Rge. 25, W. 4th Mer., and by wading in conjunction with measurements from cable car, when water is low enough.

Winter flow.—Difficulty is often experienced in obtaining accurate discharge during the winter months owing to slush-ice, and the formation of more than one layer of ice. Measurements during this season are, therefore, taken at the SW. ¼ Sec. 1, Tp. 2, Rge. 25, W. 4th Mer.

Diversions.—Alberta Railway and Irrigation Company's canal capacity about 900 second-feet, about one-half mile below the station.

Accuracy.—Stage-discharge relation permanent except during periods of high water and ice. Rating curve well defined between March 24 and April 9 and between June 24 and November 10. Between April 10 and June 23, shifting control, Bolster method applied. The operation of the Stevens water stage recorder, in use from April 10 to November 9, was satisfactory. Under ice conditions gauge read daily to one one-hundredths of a foot.

Daily discharge from January 1 to March 24, and from November 11 to December 31, ascertained from hydrograph derived from mean daily gauge height, discharge measurements and temperatures; between March 24 and April 9, by applying direct to curve plotted from readings of vertical staff at cable; Bolster method used between April 10 and June 23, and by direct application to rating table for remainder of year.

Remarks.—The United States Reclamation Service diverted 10,562 acre-feet from St. Mary river between August 1 and September 13, 1916. About 1,528 acre-feet reached the North Branch of Milk river and most of the balance returned by seepage and overflow to St. Mary river.

This station is maintained in co-operation with the stream measurement work carried on by the United States Geological Survey.

In the fall of 1916, the cable was moved to a new site, in NE. ¼ Sec. 23, Tp. 1, Rge. 25, W. 4th Mer., and gaugings will in future be made there during open water. The water stage recorder is also to be moved to a new shelter in SW. ¼ Sec. 25, Tp. 1, Rge. 25, W. 4th Mer.

Discharge Measurements of St. Mary river near Kimball, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 10	W H. Storey	69.0	92.4	1.62	4.55*c*	149
Jan. 12	do	68.0	80.2	1.86	4.53	149
Feb. 10	V. A. Newhall	40.0	53.2	4.31	5.07	230
Feb. 12	do	40.0	56.0	4.04	4.97	226
Mar. 15	S. H. Frame	363.0	193.6	2.63	5.17*c*	509*e*
Mar. 23	do	101.4	183.4	3.22	3.40*s*	589
Mar. 24	do	175.0	259.3	2.09	3.27	542
Mar. 24	do	101.0	184.0	3.37	3.27	621
April 5	do	173.0	257.0	2.11	3.26*s*	543
April 24	do	183.0	290.2	2.32	2.66*a*	672
April 25	W. A. Lamb (U.S.G.S.)	178.0	290.0	2.40	2.61	696
May 23	do	227.0	473.0	3.62	3.61	1,710
May 30	S. H. Frame	228.0	523.9	3.81	3.95	1,999
June 3	do	228.0	491.0	3.60	3.75	1,769
June 10	A. H. Tuttle (U.S.G.S.)	231.0	746.0	4.10	5.00	3,060
June 20	S. H. Frame	224.0	1,082.0	7.02	7.07	7,817
June 23	do	231.0	1,135.8	6.71	7.60	7,844
June 26	do	213.0	819.0	5.68	6.20	4,903
June 26	A. H. Tuttle (U.S.G.S.)	213.0	819.0	5.75	6.25	4,960
July 5	S. H. Frame	217.0	857.2	6.00	6.40	5,393
July 11	do	210.0	714.3	5.79	5.80	4,132
July 18	W. A. Lamb (U.S.G.S.)	161.0	548.0	5.17	5.10	3,084
July 26	S. H. Frame	158.0	409.0	3.83	4.16	1,817
Aug. 16	do	228.0	359.9	3.25	3.42	1,169
Sept. 4	do	230.0	396.6	3.51	3.67	1,394
Sept. 8	do	231.0	461.9	3.71	4.01	1,714
Sept. 26	do	145.0	235.1	2.46	2.65	578
Sept. 29	do	143.0	224.8	2.27	2.56	511
Oct. 18	do	126.0	197.9	1.73	2.22*a*	342
Nov. 17	do	108.0	190.1	2.32	4.25*c*	440
Nov. 18	W. A. Lamb (U.S.G.S.)	102.0	186.0	2.25	4.28	418
Dec. 11	H. W. Rowley	90.0	133.8	1.57	3.95*c*	210

e Discharge estimated; A.R. & I. dam as weir.
c-c Chain gauge, Jan. 10 to Mar. 15; Nov. 17 to Dec. 11.
s Staff gauge at cable.
a-a Automatic gauge.

DAILY GAUGE HEIGHT AND DISCHARGE of St. Mary river near Kimball, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.12*x*	150	4.68	232	6.03	617	3.41	658	3.08	1,080	3.93	1,980
2	.....	150*b*	4.64	221	6.10	600	3.41	658	3.17	1,165	3.92	1,960
3	4.50	152	4.75	218	6.15	583	3.38	630	3.15	1,150	3.78	1,800
4	4.60	153	4.85	217	6.15	568	3.31	580	3.17	1,175	3.81	1,770
5	4.75	154	4.75	218	.....	555*b*	3.25	532	3.24	1,240	4.11	2,050
6	4.60	154	.....	219*b*	6.00	546	3.24	530	3.47	1,450	4.36	2,320
7	4.57	153	4.96	222	6.64	539	3.26	543	3.87	1,865	4.41	2,340
8	4.55	151	5.01	228	5.49	534	3.28	560	4.13	2,170	4.44	2,340
9	.....	149*b*	4.98	230	6.14	529	.....	575*e*	4.18	2,260	4.58	2,500
10	4.55	149	5.07	230	6.99	525	2.55*x*	590	4.18	2,260	4.91	2,930
11	4.50	149	5.02	228	5.99	521	2.66	672	4.04	2,100	5.28	3,480
12	4.53	149	4.97	226	5.78	519	2.66	672	3.91	1,960	5.29	3,560
13	4.44	149	.....	240*b*	4.78	516	2.67	680	3.75	1,795	5.26	3,560
14	4.45	150	5.12	274	.....	512*b*	2.70	700	3.64	1,680	5.27	3,640
15	4.35	154	6.02	313	5.17	509	2.67	680	3.55	1,600	5.52	4,120
16	.....	157*b*	6.77	358	.....	512*b*	2.74	740	3.46	1,530	6.05	5,240
17	4.30	159	7.16	420	4.78	514	2.63	650	3.37	1,440	6.56	6,420
18	4.35	165	6.11	480	4.58	516	2.67	680	3.32	1,390	6.72	6,880
19	4.40	171	.....	524*b*	4.23	520	2.63	650	3.31	1,390	7.04	7,660
20	4.50	178	5.81	565	4.14	524	2.66	672	3.32	1,400	7.07	7,817
21	.....	191*b*	5.71	601	4.14	528	2.69	690	3.41	1,495	7.57	8,520
22	4.55	208	5.47	628	4.09	532	2.73	725	3.52	1,600	7.80	8,620
23	.....	225*b*	5.10	650	4.09	538	2.66	672	3.59	1,690	7.60	7,844
24	4.50	241	5.15	669	3.27*x*	541	2.66	672	3.71	1,805	6.67	5,890
25	4.30	255	4.98	670	3.36	615	2.61	696	3.89	1,990	6.23	4,966
26	.....	260*b*	5.00	664	.....	618*b*	2.55	660	3.99	2,100	6.24	4,987
27	4.55	261	.....	654*b*	3.37	620	2.56	660	4.04	2,140	6.30	5,113
28	4.70	260	5.20	641	3.37	620	2.65	740	3.95	2,030	6.47	5,470
29	4.75	256	5.20	630	3.36	615	2.75	810	3.91	1,960	6.97	6,520
30	.....	250*b*	.....	.....	3.36	615	2.92	945	3.95	1,999	7.07	6,730
31	4.60	242	.....	.....	3.37	620	.....	.....	3.95	2,000	.....	.....

b Discharge from winter hydrograph; ice conditions, Jan. 1 to Mar. 23; Nov. 11 to Dec. 31.
e Discharge estimated.
x Chain gauge at bridge, Jan. 1 to Mar. 23; Nov. 10 to Dec. 31.
Staff gauge at cable, Mar. 24 to April 19.
Automatic gauge, April 10 to Nov. 9.

DAILY GAUGE HEIGHT AND DISCHARGE of St. Mary river near Kimball, for 1916—*Concluded*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	6.74	6,037	3.78	1,481	3.19	964	2.48	473	2.25	357	3.60	285
2	6.65	5,848	3.73	1,433	3.19	964	2.46	462	2.31	385	3.65	274
3	6.67	5,890	3.73	1,433	3.30	1,053	2.45	457	2.33	394	.....	266
4	6.61	5,764	3.66	1,366	3.57	1,284	2.42	441	2.39	425	3.75	256
5	6.45	5,428	3.61	1,320	3.79	1,490	2.42	441	2.38	420	3.73	248
6	6.00	4,516	3.58	1,293	4.02	1,721	2.45	457	2.38	420	3.70	240
7	5.69	3,977	3.56	1,275	4.08	1,784	2.42	441	2.37	414	3.67	234
8	5.69	3,977	3.54	1,257	4.00	1,700	2.37	414	2.39	425	3.57	227
9	5.70	3,993	3.71	1,414	3.73	1,433	2.34	399	2.42	441	3.47	221
10	5.74	4,059	3.86	1,559	3.56	1,275	2.34	399	.....*x*	444*b*	.....	215*b*
11	5.80	4,159	3.87	1,569	3.44	1,171	2.31	385	3.82	446	3.95	210
13	5.73	4,042	3.81	1,510	3.33	1,078	2.29	375	3.82	448	3.55	211
13	5.75	4,075	3.70	1,404	3.23	996	2.30	380	3.82	449	4.15	212
14	5.56	3,763	3.57	1,284	3.17	949	2.31	385	3.97	449	4.10	213
15	5.45	3,585	3.48	1,205	3.14	925	2.27	366	4.00	449	4.15	214
16	5.41	3,520	3.42	1,154	3.08	880	2.25	357	4.10	446	4.55	216
17	5.34	3,407	3.42	1,154	2.99	815	2.23	348	4.25	440	.....	218
18	5.28	3,312	3.48	1,205	2.91	759	2.22	344	4.25	418	4.65	219
19	5.14	3,101	3.44	1,171	2.86	724	2.23	348	.....	404*b*	4.95	221
20	4.97	2,865	3.42	1,154	2.79	675	2.25	357	4.30	395	.....	222
21	4.81	2,656	3.39	1,129	2.76	654	2.31	385	4.25	384	5.00	224
22	4.65	2,452	3.35	1,095	2.71	619	2.37	414	4.15	374	5.15	226
23	4.55	2,327	3.30	1,053	2.70	612	2.31	385	4.10	366	5.50	229
24	4.41	2,156	3.26	1,020	2.70	612	2.30	380	4.10	359	.....	231
25	4.29	2,016	3.22	988	2.67	592	2.26	362	4.05	350	5.60	232
26	4.16	1,870	3.31	1,061	2.65	578	2.25	357	4.05	343	5.65	235
27	4.15	1,859	3.30	1,053	2.62	558	2.25	357	4.00	337	5.70	238
28	4.10	1,805	3.28	1,037	2.60	544	2.21	339	4.00	324	5.70	240
29	4.01	1,710	3.26	1,020	2.56	519	2.22	344	3.60	308	5.55	242
30	3.94	1,639	3.24	1,004	2.51	490	2.21	339	3.65	295	5.65	242
31	3.84	1,539	3.22	988	.....	.....	2.28	371	.....	.....	.....	243*b*

b Discharge from winter hydrograph; ice conditions, Jan. 1 to Mar. 23; Nov. 11 to Dec. 31.
e Discharge estimated.
x Chain gauge at bridge, Jan. 1 to Mar. 23; Nov. 10 to Dec. 31.
Staff gauge at cable, Mar. 24 to April 9.
Automatic gauge, April 10 to Nov. 9.

MONTHLY DISCHARGE of St. Mary river near Kimball, for 1916

(Drainage area 472 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	261	149	185	0.392	0.45	11,375
February	670	217	402	0.852	0.91	23,123
March	620	509	556	1.180	1.36	34,187
April	945	530	664	1.410	1.57	39,511
May	2,260	1,080	1,707	3.620	4.17	104,958
June	8,620	1,770	4,634	9.820	10.96	275,742
July	6,037	1,539	3,463	7.340	8.46	212,932
August	1,569	988	1,229	2.600	3.00	75,568
September	1,784	490	947	2.010	2.24	56,350
October	473	339	389	0.824	0.95	23,919
November	449	295	397	0.841	0.94	23,623
December	285	210	232	0.492	0.57	14,265
The year	.....	.....	.....	.....	35.58	895,553

Mean Monthly Discharge of St. Mary river at International Boundary and Kimball

(Area of Watershed, 452 sq. miles at Int. Bdy.; 472 sq. miles at Kimball)

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.	Acre.-ft.
1902	.....	.....	.....	.....	.....	.....	.....	.....	604	477	342	.....	.....
1903	.....	.....	.....	.....	1,720	5,200	2,924	1,404	1,109	917	535	438	.....
1904	.....	*a*200	*a*200	935	2,022	2,794	1,860	931	420	213	*a*122	*a*157	.....
1905	*a*90	*a*75	*a*171	295	1,215	2,461	1,642	847	371	772	298	*a*240	514,100
1906	*a*100	*a*95	*a*125	481	1,500	2,280	1,830	946	628	756	1,100	359	619,000
1907	*a*150	*a*200	*a*150	489	1,930	4,260	3,120	1,330	1,210	567	244	157	835,000
1908	*a*50	*a*100	*a*225	844	2,490	6,390	2,490	785	462	485	472	*a*125	900,000
1909	.....	.....	.....	.....	1,907	5,646	3,097	1,466	645	453	683	.....	.....
1910	*a*150	*a*160	*a*530	1,190	2,320	2,240	1,170	580	553	1,040	742	293	664,000
1911	210	189	196	527	2,070	3,651	1,783	1,044	1,377	676	334	190	740,254
1912	171	138	130	493	1,966	2,295	1,644	882	547	423	496	246	571,741
1913	158	129	191	749	1,912	4,519	2,024	1,162	542	418	371	190	749,112
1914	128	101	184	637	2,230	2,331	1,430	719	584	841	702	256	614,631
1915	168	117	157	575	1,645	2,251	1,722	969	842	*b*579	*b*405	243	585,988
1916	185	402	556	664	1,707	4,634	3,463	1,229	947	389	397	232	895,553
Average Sec.-ft.	142	159	234	657	1,902	3,640	2,157	1,021	723	603	483	240	699,050
Average Acre-ft.	8,731	8,830	14,388	39,094	116,949	216,595	132,629	62,779	43,021	37,077	28,740	14,757	723,600

a Estimated or partly estimated.
b Subject to revision.

Note:—The above table summarizing the stream flow data for the St. Mary river, where it crosses the International Boundary, has been prepared from the United States Geological Survey records at their former gauging station near the boundary and from the records of the former Canadian gauging station near Kimball, together with the recent records gained at the joint station now maintained near the latter place by the representatives of the two Governments.

MEAN MONTHLY DISCHARGE in Second-feet of St. Mary river near Kimball

MONTH	1907–8	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	.....	453	1,114	676	423	448	841	579	389	615	37,838
November	.....	.....	*d*683	711	334	496	371	702	405	397	488	29,038
December	.....	.....	.....	.....	190	246	190	256	243	232	226	13,903
January	.....	.....	.....	210	171	158	128	168	185	.....	170	10,457
February	.....	.....	.....	189	138	129	101	117	402	.....	179	10,140
March	.....	.....	.....	196	130	191	184	157	556	.....	236	14,488
April	.....	*c*505	1,068	527	493	749	637	575	664	.....	673	40,066
May	.....	1,906	2,206	2,070	1,966	1,912	2,230	1,645	1,707	.....	1,955	120,224
June	*a*3,108	5,646	2,208	3,651	2,295	4,519	2,331	2,251	4,634	.....	3,442	204,804
July	2,395	3,096	1,176	1,783	1,644	2,024	1,430	1,722	3,463	.....	2,081	127,987
August	947	1,466	562	1,044	882	1,162	719	969	1,229	.....	998	61,354
September	*b*529	645	544	1,377	547	542	584	842	947	.....	754	44,835
Total in acre-ft.	287,044	777,092	524,786	777,974	574,177	758,454	566,714	620,571	908,387	.....	.....	715,134

a 21-30.
b 1-19.
c 26-30.
d 1-20.

ALBERTA RAILWAY AND IRRIGATION COMPANY'S CANAL AT KIMBALL

Location.—On the SE. ¼ Sec. 36, Tp. 1, Rge. 25, W. 4th Mer., at a concrete measuring section five hundred feet below the control gates at the intake of the A.R. & I. Co.'s canal.

Records available.—During irrigation season from April 27, 1915, to October 7, 1916.

Gauge.—Inclined staff, set in concrete slopes of 1½ to 1. Graduations on staff developed for slopes of 1½ to 1. Gauge read by W. D. Willgrass.

Channel.—Above and below section, stream bed is composed of loose gravel and boulders. At section bed is composed of mixed gravel, levelled and tamped. Stream bed not liable to shift as velocities are not excessive.

Discharge measurements.—Made from foot-bridge having a trussed-span of forty-four feet; one hand rail upstream side.

Artificial control.—The discharge is controlled by headgates five hundred feet above the measuring section.

Remarks.—This station serves to register the amount of water diverted from the St. Mary river at Kimball for the A.R. & I. Co.'s purposes. In wet seasons there is more water registered at the A.R. & I. Co.'s flume, six miles below the headgates, owing to ground water flowing into the canal, but in dry seasons the diversion from the St. Mary river is the sole source of supply.

DISCHARGE MEASUREMENTS of Alberta Railway and Irrigation Company's canal, at Kimball, for 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 25	S. H. Frame	29.2	50.7	2.23	1.92	113
May 30	do	29.9	56.3	2.30	2.10	129
June 20	do	32.4	82.2	2.73	2.87	225
June 23	do	32.3	80.9	2.69	2.91	218
June 26	do	33.2	88.8	2.85	3.13	254
July 5	do	33.0	88.3	2.88	3.16	254
July 11	do	33.0	88.8	2.88	3.15	256
July 26	do	33.2	88.1	2.83	3.14	250
Aug. 15	do	33.3	89.8	2.80	3.15	252
Sept. 4	do	33.0	88.1	2.85	3.13	251
Sept. 8	do	30.9	63.4	2.46	2.35	156
Sept. 21	W. A. Burton	30.5	63.4	2.33	2.35	148
Sept. 26	S. H. Frame	31.2	70.6	2.47	2.55	174
Sept 29	do	31.2	69.4	2.49	2.55	173

DAILY GAUGE HEIGHT AND DISCHARGE of Alberta Railway and Irrigation Conpany's canal at Kimball, in 1916

Day	April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	2.30	147	2.10	128
2	.....	.....	2.45	163	2.09	127
3	.....	.....	2.60	179	2.10	128
4	.....	.....	2.60	179	2.15	133
5	.....	.....	2.59	178	2.21	138
6	.....	.....	2.60	179	2.20	137
7	.....	.....	2.61	181	2.21	138
8	.....	.....	2.60	179	2.25	142
9	.....	.....	2.70	192	2.41	158
10	.....	.....	2.69	190	2.40	157
11	.....	.....	2.70	192	2.41	158
12	.....	.....	2.70	192	2.40	157
13	.....	.....	2.71	193	2.41	158
14	.....	.....	2.70	192	2.40	157
15	.....	.....	2.89	217	2.40	157
16	.....	.....	3.10	246	2.72	194
17	.....	.....	3.20	261	2.80	205
18	.....	.....	3.30	276	2.90	218
19	.....	.....	3.50	307	2.89	217
20	.....	.....	3.66	333	2.87	214
21	.....	.....	3.80	356	2.95	225
22	.....	.....	3.81	357	2.99	231
23	.....	.....	3.81	257	2.91	220
24	.....	.....	3.80	356	2.98	229
25	1.92*h*	114	2.85	211	3.16	255
26	.....*h*	.....	1.90	112	3.13	251
27	.....*h*	.....	1.90	112	3.14	252
28	1.50*h*	86	2.00	120	3.14	252
29	2.02	122	2.11	129	3.15	254
30	2.15	133	2.10	128	3.14	252
31	.....	.....	2.11	129	.....	.....

h Headgate opened April 25; April 28 to October 7.
Headgate closed April 26-27.

DAILY GAUGE HEIGHT AND DISCHARGE of Alberta Railway and Irrigation Company's canal at Kimball, for 1916.—*Concluded.*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.14	252	3.16	255	3.16	255	2.55	174
2	3.15	254	3.15	254	3.15	254	2.55	174
3	3.16	255	3.15	254	3.16	255	2.55	174
4	3.16	255	3.15	254	3.13	251	2.55	174
5	3.16	255	3.15	254	2.35	152	2.30	147
6	3.16	255	3.15	254	1.95	116	2.05	124
7	3.14	252	3.15	254	2.35	152	2.05	124
8	3.15	254	3.14	252	2.35	152	....*h*	....
9	3.15	254	3.16	255	2.35	152	....	....
10	3.15	254	3.15	254	2.35	152	....	....
11	3.15	254	3.15	254	2.35	152	....	....
12	3.14	252	3.15	254	2.35	152	....	....
13	3.15	254	3.14	252	2.36	153	....	....
14	3.15	254	3.15	254	2.34	151	....	....
15	3.15	254	3.15	254	2.35	152	....	....
16	3.15	254	3.15	254	2.35	152	....	....
17	3.16	255	3.16	255	2.35	152	....	....
18	3.15	254	3.15	254	2.35	152	....	....
19	3.15	254	3.14	252	2.35	152	....	....
20	3.15	254	3.15	254	2.35	152	....	....
21	3.14	252	3.14	252	2.35	152	....	....
22	3.16	255	3.16	255	2.60	179	....	....
23	3.14	252	3.15	254	2.85	211	....	....
24	3.15	254	3.15	254	2.85	211	....	....
25	3.14	252	3.15	254	2.70	192	....	....
26	3.14	252	3.15	254	2.55	174	....	....
27	3.16	255	3.16	255	2.55	174	....	....
28	3.15	254	3.14	252	2.55	174	....	....
29	3.14	252	3.15	254	2.55	174	....	....
30	3.15	254	3.15	254	2.55	174	....	....
31	3.14	252	3.14	252	....	....	....	....

h Headgate closed October 7.

MONTHLY DISCHARGE of Alberta Railway and Irrigation Company's canal at Kimball, for 1916

MONTH	DISCHARGE IN SECOND-FEET			RUN-OFF
	Maximum	Minimum	Mean	Total Discharge in Acre.-ft.
April (25-30)	133	86	114	904
May	357	112	211	12,974
June	255	127	188	11,187
July	255	252	254	15,618
August	255	252	254	15,618
September	255	116	174	10,354
October (1-7)	174	124	156	2,166
The period	....	....	....	68,821

ALBERTA RAILWAY AND IRRIGATION COMPANY'S CANAL NEAR KIMBALL

Location.—On the SE. ¼ Sec. 21, Tp. 2, Rge. 24, W. 4th Mer., at the flume over Rolph creek, constructed in 1914.

Records available.—During irrigation seasons from July 26, 1910, to October 7, 1916.

Gauge.—Vertical staff; zero level with bottom of flume at gauge. Gauge read by J. M. Dunn.

Channel.—Smooth plank flume 768 feet long.

Discharge measurements.—Made from a foot-bridge, spanning the flume at a point about midway from the ends.

Artificial control.—The discharge is controlled by headgates at Kimball about six miles above the flume.

DISCHARGE MEASUREMENTS of Alberta Railway and Irrigation Company's canal (flume) near Kimball, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq.-ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
June 2	S. H. Frame	27.0	53.1	2.31	1.95	123
June 24	do	27.0	71.0	3.09	2.53	219
July 27	do	27.0	72.9	3.40	2.67	248
Aug. 17	do	27.0	72.9	3.42	2.70	249
Sept. 5	do	27.0	72.9	3.34	2.70	244
Sept. 27	do	27.0	62.1	2.79	2.26	173

DAILY GAUGE HEIGHT AND DISCHARGE of Alberta Railway and Irrigation Company's canal (flume) near Kimball, for 1916

Day	April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			2.12	149	1.95	123
2			2.10	146	1.95	123
3			2.27	174	1.95	123
4			2.28	175	1.95	123
5			2.28	175	2.04	137
6			2.28	175	2.00	130
7			2.28	175	2.00	130
8			2.30	179	2.05	138
9			2.35	187	2.20	162
10			2.35	187	2.16	156
11			2.35	187	2.15	154
12			2.35	187	2.15	154
13			2.35	187	2.15	154
14			2.35	187	2.15	154
15			2.65	240	2.15	154
16			2.60	231	2.30	179
17			2.60	231	2.38	192
18			2.75	259	2.50	213
19			2.93	295	2.50	213
20			2.93	295	2.50	213
21			3.15	340	2.40	196
22			3.15	340	2.55	222
23			3.15	340	2.50	213
24			3.15	340	2.53	218
25				221*e*	2.60	231
26			1.80	102	2.66	242
27			1.80	102	2.66	242
28	1.50*h*	68	1.95	123	2.68	246
29	2.03	135	1.95	123	2.68	246
30	1.90	116	1.95	123	2.65	240
31			1.95	123		

h Headgate opened April 28.

DAILY GAUGE HEIGHT AND DISCHARGE of Alberta Railway and Irrigation Company's canal (flume) near Kimball, for 1916—*Concluded*

Day	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.68	246	2.67	244	2.67	244	.....	172*e*
2	2.70	249	2.67	244	2.68	246	2.26	172
3	2.70	249	2.67	244	.....	248*e*	2.26	172
4	2.66	242	2.67	244	2.70	249	2.26	172
5	2.68	246	2.67	244	2.70	249	2.27	174
6	2.68	246	.....	244*e*	1.60	79	1.92	119
7	2.68	246	2.67	244	2.10	146	1.92*h*	119
8	2.70	249	2.66	242	2.12	149	.....	.....
9	2.68	246	2.67	244	2.12	149	.....	.....
10	2.68	246	2.67	244	.....	149*e*	.....	.....
11	2.69	246	2.67	244	2.12	149	.....	.....
12	2.68	246	2.67	244	2.10	146	.....	.....
13	2.68	246	2.67	244	2.12	149	.....	.....
14	2.67	244	2.67	244	2.12	149	.....	.....
15	2.68	246	2.67	244	2.12	149	.....	.....
16	2.68	246	2.68	246	2.12	149	.....	.....
17	2.68	246	2.70	249	.....	149*e*	.....	.....
18	2.68	246	2.68	246	2.12	149	.....	.....
19	2.67	244	2.67	244	2.12	149	.....	.....
20	2.68	246	2.67	244	2.12	149	.....	.....
21	2.68	246	2.67	244	2.12	149	.....	.....
22	2.68	246	2.67	244	2.50	213	.....	.....
23	2.68	246	2.67	244	2.50	213	.....	.....
24	2.67	244	2.67	244	.....	213*e*	.....	.....
25	2.68	246	2.67	244	2.50	213	.....	.....
26	2.68	246	2.67	244	2.20	162	.....	.....
27	2.67	244	2.67	244	2.26	172	.....	.....
28	2.67	244	2.67	244	2.26	172	.....	.....
29	2.67	244	2.67	244	2.26	172	.....	.....
30	2.67	244	2.67	244	2.26	172	.....	.....
31	2.67	244	2.68	246	.....	.....	.....	.....

h Headgate closed October 7.

MONTHLY DISCHARGE of Alberta Railway and Irrigation Company's canal (flume) near Kimball, for 1916

Month	Discharge in Second-Feet			Total Discharge in acre-ft.
	Maximum	Minimum	Mean	
April (28-30)	135	68	106	631
May	340	102	203	12,482
June	246	123	181	10,770
July	249	242	246	15,126
August	249	242	244	15,003
September	249	79	175	10,413
October (1-7)	174	119	157	2,179
The Period	.....	.....	.....	66,604

MEAN MONTHLY DISCHARGE of Alberta Railway and Irrigation flume near Kimball

YEAR	April Sec.-ft.	May Sec.-ft.	June Sec.-ft.	July Sec.-ft.	Aug. Sec.-ft.	Sept. Sec.-ft.	Oct. Sec.-ft.	Total Acre-ft.	REMARKS
1910....	0	289	628	571	472	414	260*b*	146,999	(*a*) Reduced to monthly average.
1911....	204*b*	269	382	376	387	273	330*b*	117,950	
1912....	0	260	500	330	298	309	140*b*	103,295	(*b*) Partial months only.
1913....	0	262	526	351	381	340	326*b*	118,468	
1914....	283*b*	454	696	666	542	368	329*b*	170,538	
1915....	154*b*	323	312	222	195	243	231*b*	83,412	
1916....	106*b*	203	181	246	244	175	157*b*	66,604	
Average Sec.-ft.	17*a*	294	460	352	360	303	76*a*	115,372	
Average Acre-ft.	1,012	18,077	27,372	21,644	22,136	18,030	4,673	112,944	

ROLPH CREEK NEAR KIMBALL

Location.—On the SE. ¼ Sec. 21, Tp. 2, Rge. 24, W. 4th Mer.

Records available.—May 17, 1911, to October 31, 1916.

Gauge.—Vertical staff. Zero of gauge maintained at 93.41 feet during 1913-16.

Bench-mark.—Permanent iron bench-mark located on the left bank, 100.00 feet down stream from the gauge; assumed elevation 100.00 feet.

Channel.—Consists of sand, gravel and stone; likely to shift.

Discharge measurements.—Made with current-meter by wading.

Winter flow.—Records have not been obtained during the winter season.

Observer.—J. M. Dunn.

DISCHARGE MEASUREMENTS of Rolph creek near Kimball, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 6	S. H. Frame	15.6	11.9	2.08	1.30	25.0
June 2	do	34.5	35.3	2.64	1.75	93.0
June 24	do	20.0	15.6	2.00	1.27	31.0
July 27	do	12.0	7.5	0.87	0.97	6.5
Aug. 17	do	15.0	12.0	1.38	1.15	16.6
Sept. 5	do	23.0	22.0	2.70	1.57	60.0
Sept. 27	do	11.0	6.7	1.25	1.04	8.4

DAILY GAUGE HEIGHT AND DISCHARGE of Rolph creek near Kimball, for 1916

DAY	April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.40	38.0	1.15	14.9	1.75	93
2	.....	35.0*e*	1.20	18.5	1.75	93
3	1.35	32.0	1.22	20.0	1.75	93
4	.....	30.0*e*	1.20	18.5	.....	79*e*
5	1.32	29.0	1.18	17.1	1.60	64
6	1.30	27.0	1.15	14.9	2.00	150
7	.....	27.0*e*	.....	13.5*e*	1.75	93
8	1.30	27.0	1.10	12.1	1.60	64
9	.....	26.0*e*	1.10	12.1	1.56	58
10	1.28	25.0	1.08	11.1	1.50	50
11	.....	22.0*e*	1.05	9.6	.....	49*e*
12	1.20	18.5	1.05	9.6	1.48	48
13	.....	17.0	1.05	9.6	1.47	46
14	1.16	15.6	.....	9.6*e*	1.45	44
15	1.15	14.9	1.05	9.6	1.40	38
16	.....	14.9*e*	1.05	9.6	1.30	27
17	1.15	14.9	1.05	9.6	1.25	22
18	.....	14.9*e*	1.05	9.6	1.25	22
19	.....	14.9*e*	1.05	9.6	.....	22*e*
20	1.15	14.9	1.05	9.6	1.25	22
21	1.15	14.9	1.05	9.6	1.27	24
22	1.15	14.9	1.08	11.1	1.35	32
23	.....	14.9	1.10	12.1	1.30	27
24	1.15	14.9	1.20	18.5	1.27	24
25	1.12	13.2	.....	75.0*e*	1.27	24
26	1.10	12.1	1.75	93.0	1.28	25
27	1.10	12.1	1.75	93.0	1.30	27
28	1.10	12.1	1.70	82.0	1.85	116
29	1.12	13.2	1.68	79.0	1.75	93
30	1.12	13.2	1.90	127.0	2.05	161
31	.....	.....	1.85	116.0	.....	.....

e Discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of Rolph creek near Kimball, for 1916—*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.85	116.0	0.97	6.6	1.14	14.3	0.98	7.0
2	1.70	82.0	0.97	6.6	1.15	14.9	0.98	7.0
3	1.60	64.0	0.97	6.6	.....	21.0*e*	0.98	7.0
4	1.50	50.0	0.97	6.6	1.30	27.0	0.95	6.0
5	1.40	38.0	0.97	6.6	1.57	60.0	0.98	7.0
6	1.30	27.0	.....	6.6*e*	1.35	32.0	1.05	9.6
7	1.25	22.0	0.97	6.6	1.30	27.0	1.00	7.6
8	1.20	18.5	0.97	6.6	1.25	22.0	.....	9.8*e*
9	1.15	14.9	1.15	14.9	1.20	18.5	1.10	12.1
10	1.15	14.9	1.30	27.0	.....	18.5*e*	1.12	13.2
11	1.10	12.1	1.25	22.0	1.20	18.5	1.15	14.9
12	1.08	11.1	1.23	21.0	1.20	18.5	1.13	13.8
13	1.05	9.6	1.22	20.0	1.18	17.1	.....	13.5*e*
14	1.03	8.8	1.20	18.5	1.16	15.6	1.12	13.2
15	0.97	6.6	1.18	17.1	1.15	14.9	.....	13.2*e*
16	.....	6.6*e*	1.18	17.1	1.15	14.9	1.12	13.2
17	0.97	6.6	1.15	14.9	.....	14.0*e*	1.11	12.7
18	0.96	6.3	1.20	18.5	1.12	13.2	1.11	12.7
19	0.96	6.3	1.18	17.1	1.10	12.1	.....	12.4*e*
20	0.96	6.3	1.16	15.6	1.10	12.1	1.10	12.1
21	0.95	6.0	1.15	14.9	1.10	12.1	1.10	12.1
22	0.94	5.8	1.14	14.3	1.10	12.1	1.10	12.1
23	.....	5.8*e*	1.12	13.2	1.10	12.1	1.10	12.1
24	0.94	5.8	1.10	12.1	.....	12.1*e*	1.10	12.1
25	0.94	5.8	1.10	12.1	1.10	12.1	1.12	13.2
26	0.95	6.0	1.10	12.1	1.10	12.1	1.12	13.2
27	0.97	6.6	1.10	12.1	1.04	9.2	1.12	13.2
28	0.97	6.6	1.10	12.1	1.00	7.6	1.11	12.7
29	0.97	6.6	1.10	12.1	0.98	7.0	.....	12.4*e*
30	0.97	6.6	1.10	12.1	0.98	7.0	1.10	12.1
31	0.97	6.6	1.10	12.1	.....	.....	1.10	12.1

e Discharge estimated.

MONTHLY DISCHARGE of Rolph creek near Kimball, for 1916

(Drainage area 74 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
April	38.0	12.1	19.8	0.268	0.30	1,178
May	127.0	9.6	31.0	0.419	0.48	1,906
June	150.0	22.0	58.0	0.784	0.87	3,451
July	116.0	5.8	19.2	0.259	0.30	1,181
August	27.0	6.6	13.4	0.181	0.21	824
September	60.0	7.0	17.0	0.230	0.26	1,012
October	14.9	6.0	11.5	0.155	0.18	707
The period	.....	.....	.....	.....	2.60	10,259

MEAN MONTHLY DISCHARGE of Rolph creek near Kimball

Area of Watershed 74 square miles
Average run-off per square mile 87.3 acre-feet

YEAR	Mar. Sec.-ft.	April Sec.-ft.	May Sec.-ft.	June Sec.-ft.	July Sec.-ft.	Aug. Sec.-ft.	Sept. Sec.-ft.	Oct. Sec.-ft.	Nov. Sec.-ft.	Total Acre-ft.
1911	.....	.....	39*a*	23	2	2	8	5	3	3,683
1912	.....	.....	11	2	6	2	1	4	4*a*	1,702
1913	.....	36*a*	16	5	6	3	1	5	.....	3,866
1914	.....	18	4	0	0	1	0	12	.....	2,129
1915	39*b*	10	12	82	40	31	24	16	.....	13,761
1916	.....	20	31	58	19	13	17	12	.....	10,259
Average sec.-ft.	.....	20	19	28	12	9	8	9	2	5,900
Average acre-ft.	.....	1,190	1,168	1,666	738	553	476	553	119	6,463

a Reduced to monthly average.
b Partial month.

LEE CREEK AT LAYTON'S RANCH

Location.—On the SE. ¼ Sec. 27, Tp. 2, Rge. 26, W. 4th Mer., at B. Layton's ranch.

Records available.—May 25, 1913, to December 31, 1916.

Gauge.—Vertical staff from 1913 to June 6, 1915, zero maintained at 88.14; June 6, 1915, to October 13, 1916, zero maintained at 90.79. Open chain gauge installed October 14, 1916, with new zero of 91.24. Gauge read by B. Layton.

Bench-marks.—Permanent iron bench-mark, assumed elevation 100.00 feet, located on the left bank about fifty feet west of chain gauge.

Channel.—Straight and quite uniform with a flat rock and boulders bed, not liable to shift.

Discharge measurements.—Made by wading at all ordinary stages, and from a temporary cable at very high stages.

Winter flow.—Obtained through the ice 800 feet above the gauge.

Remarks.—The town of Cardston takes its water supply from this stream, the intake being about one-half mile below the gauging station.

DISCHARGE MEASUREMENTS of Lee creek at Layton's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 15	W. H Storey	38.0	33.7	0.56	2.47*b*	19.0
Jan. 22	V. A. Newhall	34.0	21.0	0.98	2.17	21.0
Feb. 5	do	32.0	18.4	0.80	3.32	14.8
Mar. 4	do	31.0	19.4	1.23	3.01*b*	24.0
Mar. 31	S. H. Frame	42.0	50.4	1.88	1.70	94.0
April 21	do	48.0	60.2	2.05	1.84	123.0
May 12	do	58.0	70.1	2.36	1.93	165.0
July 7	do	66.0	92.4	2.88	2.30	265.0
July 22	W. A. Burton	49.0	56.2	1.61	1.63	90.0
Aug. 23	S. H. Frame	37.0	36.2	1.17	1.20	42.0
Sept. 11	do	39.5	36.3	0.99	1.18	36.0
Sept. 19	W. A. Burton	38.0	31.7	0.85	1.06	27.0
Oct. 14	S. H. Frame	38.0	85.4	1.24	1.25	44.0
Nov. 22	do	29.0	23.4	2.09	1.25*b*	49.0
Nov. 29	H. W. Rowley	22.0	15.6	1.41	1.12*b*	22.0
Dec. 18	do	18.0	24.6	1.02	1.54*b*	25.0

b Ice conditions.

DAILY GAUGE HEIGHT AND DISCHARGE of Lee creek at Layton's ranch, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	18.4	2.67	8.6	3.00	21	1.78	114	1.90	141	2.87	470
2	2.01*b*	18.5	2.77	9.3	2.87	22	1.76	111	2.12	202	2.78	438
3	2.09	19.0	2.92	10.8	2.87	23	1.72	104	2.14	209	2.75	427
4	2.09	19.5	3.12	12.8	3.01	24	1.70	100	2.16	215	2.75	427
5	2.09	20.0	3.32	14.8	2.92	27	1.68	97	2.20	229	2.70	409
6	2.10	21.0	3.02	16.2	2.82	32	1.72	104	2.22	236	2.70	409
7	2.10	21.0	2.84	17.2	3.02	40	1.79	116	2.45	319	2.75	427
8	2.13	20.0	2.77	18.4	.....	49	1.78	114	2.30	265	2.84	459
9	2.22	18.3	2.77	19.7	3.12	61	.....	114*e*	2.25	247	2.90	481
10	.....	16.2	2.77	21.0	2.92	70	1.78	114	2.05	180	3.15	571
11	2.37	15.3	2.77	23.0	2.82	81	1.82	122	1.97	158	.....	326*e*
12	2.44	15.4	2.77	26.0	2.62	92	1.85	129	1.93	148	2.90	481
13	2.48	16.2	2.62	29.0	2.22	107	1.90	141	1.93	148	2.80	445
14	2.52	17.8	2.52	44.0	1.97	116	1.97	158	.....	150*e*	2.72	416
15	2.47	19.0	2.92	126.0	1.94	126	2.06	183	1.94	151	2.68	402
16	2.52	21.0	3.42	218.0	1.92	135	.....	174*e*	1.95	153	2.65	391
17	2.52	22.0	4.62	300.0	1.90	148	2.00	166	1.90	141	2.70	409
18	2.54	23.0	4.32	245.0	1.87	157	1.94	151	1.87	134	2.75	427
19	2.57	23.0	4.02	190.0	1.85	161	1.90	141	1.84	127	2.73	420
20	2.42	23.0	3.80	132.0	1.82*b*	161	1.87	134	1.88	136	2.70	409
21	2.27	22.0	3.62	75.0	1.98	161	1.84	127	1.90	141	2.65	391
22	2.17	21.0	3.42	38.0	1.92	146	1.84	127	1.96	156	2.60	373
23	2.17	19.7	3.52	31.0	1.87	134	1.85	129	2.04	177	2.55	355
24	2.20	17.7	3.27	27.0	1.82	122	1.88	136	2.50	337	2.42	308
25	2.24	15.6	3.02	25.0	1.72	104	1.94	151	2.60	373	2.70	409
26	2.29	13.8	2.87	23.0	1.72	104	1.90	141	2.73	420	2.90	481
27	2.32	12.2	.....	22.0	1.71	102	1.87	134	2.75	427	3.36	647
28	2.39	10.8	2.96	22.0	1.70	100	1.83	125	2.90	481	3.74	783
29	2.44	9.5	3.00	21.0	1.70	100	1.84	127	3.02	524	4.10	913
30	2.52	8.8	.....	.....	.....	100*e*	1.85	129	2.98	510	3.90	841
31	2.57	8.5	.....	.....	1.70	100	.....	.....	3.00	517	.....	.....

b-*b* Ice conditions. Discharge taken from winter hydrograph.
c Discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of Lee creek at Layton's ranch, for 1916.—*Concluded.*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	607*e*	1.27	45	1.18	37	1.00	24	1.18	37	1.14	21.0
2	2.60	373	1.24	42	1.22	41	1.00	24	1.18	37	1.14	21.0
3	2.58	366	1.22	41	1.25	43	1.05	27	1.20	39	1.15	21.0
4	2.56	359	1.21	40	1.23	41	1.07	29	1.20	39	1.17	22.0
5	2.52	344	1.20	39	1.21	40	1.08	29	1.18	37	1.18	23.0
6	2.48	330	1.19	38	1.20	39	1.08	29	1.18*b*	34	1.21	24.0
7	2.30	265	1.18	37	1.20	39	1.08	29	1.15	29	1.25	25.0
8	2.33	276	1.30	48	1.20	39	1.15	35	1.15	27	1.28	26.0
9	2.23	240	1.77	113	1.19	38	1.18	37	1.15	27	1.32	26.0
10	2.15	212	1.68	97	1.19	38	1.18	37	1.15	27	1.38	27.0
11	2.05	180	1.62	87	1.18	37	1.17	37	1.20	28	1.44	28.0
12	2.00	166	1.53	74	1.18	37	1.16	36	1.28	30	1.50	28.0
13	1.97	158	1.46	65	1.17	37	1.15	35	1.40	34	1.50	28.0
14	1.92	146	1.40	58	1.17	37	1.25	43	1.38	37	1.51	28.0
15	1.88	136	1.32	50	1.16	36	1.23	41	1.38	40	1.51	28.0
16	1.85	129	1.29	47	1.15	35	1.20	39	.....	42	.....	27.0
17	1.82	122	1.28	46	1.13	33	1.20	39	1.42	45	1.52	26.0
18	1.90	118	1.26	44	1.11	32	1.20	39	1.40	47	1.54	25.0
19	1.76	111	1.25	43	1.06	28	1.20	39	1.38	48	1.55	24.0
20	1.72	104	1.24	42	1.08	29	1.19	38	1.32	49	1.58	23.0
21	1.70	100	1.23	41	1.07	29	1.19	38	1.28	49	1.60	23.0
22	1.63	89	1.22	41	1.07	29	1.18	37	1.25	49	1.60	22.0
23	1.62	87	1.20	39	1.05	27	1.18	37	1.23	46	1.56	21.0
24	1.58	81	1.19	38	1.04	26	1.18	37	.....	41	1.50	21.0
25	1.50	70	1.18	37	1.04	26	1.17	37	1.19	35	1.45	20.0
26	1.52	73	1.18	37	1.02	25	1.17	37	1.16	29	1.45	19.5
27	1.48	68	1.16	36	1.00	24	1.17	37	1.12	25	1.45	19.5
28	1.45	64	1.16	36	1.00	24	1.16	36	1.10	23	1.45	20.0
29	1.39	56	1.15	35	0.98	21	1.16	36	1.12	22	1.45	21.0
30	1.32	50	1.14	34	0.98	21	1.15	35	1.12	21	1.45	21.0
31	1.29	47	1.14	34	.....	.....	1.15	35	.....	.....	.....*b*	21.0

b-b Ice conditions. Discharge taken from winter hydrograph.
e Discharge estimated.

MONTHLY DISCHARGE of Lee creek at Layton's ranch, for 1916

(Drainage area 92 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	23	8.5	17.6	0.191	0.22	1,082
February	300	8.6	61.0	0.663	0.72	3,509
March	161	21.0	94.0	1.020	1.18	5,780
April	183	97.0	130.0	1.410	1.57	7,736
May	524	127.0	250.0	2.720	3.14	15,372
June	913	308.0	478.0	5.200	5.80	28,443
July	607	47.0	178.0	1.930	2.22	10,945
August	113	34.0	49.0	0.533	0.61	3,013
September	43	21.0	33.0	0.359	0.40	1,964
October	43	24.0	35.0	0.380	0.44	2,152
November	49	21.0	36.0	0.391	0.44	2,142
December	28	19.5	24.0	0.261	0.30	1,476
The year	.....	.....	.....	.....	17.04	83,614

MEAN MONTHLY DISCHARGE of Lee creek at Layton's ranch

(Area of watershed 92 square miles)
(Average run-off per square mile 623 acre-feet)

YEAR	Jan. Sec.-ft.	Feb. Sec.-ft.	Mar. Sec.-ft.	April Sec.-ft.	May Sec.-ft.	June Sec.-ft.	July Sec.-ft.	Aug. Sec.-ft.	Sept. Sec.-ft.	Oct. Sec.-ft.	Nov. Sec.-ft.	Dec. Sec.-ft.	Total Acre-ft.
1913	.....	.....	.....	.....	162	153	72	36	20	31	36	9	*29,900a*
1914	15	9	21	82	127	94	34	20	17	65	60	17	33,900
1915	17	14	26	63	175	359	151	92	71	91	56	36	69,600
1916	18	61	94	130	250	478	178	49	33	35	36	24	83,614
Average Sec.-Ft.	17	28	47	92	178	271	109	49	35	55	47	21	62,371
Average Acre-ft. .	1,045	1,555	2,890	5,474	10,945	16,126	6,702	3,013	2,083	3,382	2,797	1,291	57,303

a Records incomplete, not included in average.

PINEPOUND CREEK NEAR SPRING COULEE (PACKARD'S FARM)

Location.—On the NE. ¼ Sec. 29, Tp. 4, Rge. 23, W. 4th Mer.

Records available.—April 30, 1914, to October 31, 1916.

Gauge.—Vertical staff. Zero of gauge maintained at elevation of 93.00 feet since established. Gauge read by D. M. Boyd.

Bench-mark.—Permanent iron bench-mark located fifty feet northeast of the gauge; assumed elevation 100.00 feet.

Channel.—Composed of sand, gravel and small stones, not liable to shift on account of the good control located about 100 feet below the gauge.

Discharge measurements.—Made by wading.

Winter flow.—Station discontinued during winter season.

Remarks.—The greater portion of discharge is waste water from the Alberta Railway and Irrigation Company's canal.

DISCHARGE MEASUREMENTS of Pinepound creek near Spring Coulee (Packard's farm), in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
March 20	S. H. Frame	10.5	4.9	0.52	2.66	2.50*b*
April 14	do	12.5	4.4	1.17	2.64	5.00
May 9	do	9.0	2.4	0.72	2.49	1.73
May 27	do	12.0	5.6	1.54	2.72	8.60
July 17	W. A. Burton	12.5	5.4	1.24	2.68	6.70
Aug. 21	S. H. Frame	.....	.....	.....	2.34	0.09*w*
Sept. 18	W. A. Burton	.....	.....	.....	2.35	0.06*w*
Oct. 9	S. H. Frame	.....	.....	.....	2.35	0.16*w*

b Ice conditions.
w Discharge determined by using a six-inch weir.

DAILY GAUGE HEIGHT AND DISCHARGE of Pinepound creek near Spring Coulee (Packard's farm) for 1916

DAY	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	2.82	14.00	2.47	1.45	2.67	6.3
2	.....	.....	2.83	14.50	2.47	1.45	2.68	6.7
3	.....	.....	2.85	15.60	2.48	1.60	2.79	12.4
4	.....	.....	2.79	12.40	2.49	1.75	2.79	12.4
5	.....	.....	2.70	7.60	2.52	2.30	2.77	11.3
6	.....	.....	2.70	7.60	2.52	2.30	2.78	11.8
7	.....	.....	2.69	7.20	2.52	2.30	2.69	7.2
8	.....	.....	2.68	6.70	2.51	2.10	2.69	7.2
9	.....	.....	2.61	4.30	2.49	1.75	2.69	7.2
10	.....	.....	2.62	4.60	2.49	1.75	2.67	6.3
11	.....	.....	2.64	5.10	2.50	1.90	2.65	5.4
12	.....	.....	2.63	4.80	2.51	2.10	2.65	5.4
13	.....	.....	2.61	4.30	2.51	2.10	2.63	4.8
14	.....	.....	2.64	5.10	2.52	2.30	2.62	4.6
15	.....	.....	2.61	4.30	2.50	1.90	2.62	4.6
16	.....	.....	2.62	4.60	2.50	1.90	2.63	4.8
17	.....	.....	2.61	4.30	2.50	1.90	2.63	4.8
18	.....	.....	2.60	4.00	2.51	2.10	2.65	5.4
19	.....	.....	2.59	3.80	2.51	2.10	2.70	7.6
20	2.66*b*	5.0	2.56	3.00	2.50	1.90	2.69	7.2
21	3.08	25.0	2.57	3.30	2.50	1.90	2.68	6.7
22	2.95	20.0	2.56	3.00	2.51	2.10	2.70	7.6
23	2.89*b*	15.0	2.55	2.80	2.52	2.30	2.65	5.4
24	2.83	14.5	2.53	2.40	2.59	3.80	2.67	6.3
25	2.76	10.7	2.52	2.30	2.61	4.30	2.66	5.8
26	2.75	10.2	2.52	2.30	2.69	7.20	2.66	5.8
27	2.78	11.8	2.53	2.40	2.72	8.60	2.64	5.1
28	2.74	9.7	2.52	2.30	2.71	8.10	2.66	5.8
29	2.80	12.9	2.50	1.90	2.70	7.60	2.66	5.8
30	2.81	13.4	2.48	1.60	2.72	8.60	2.55	2.8
31	2.86	16.1	.....	.....	2.65	5.40	.....	.....

b–*b* Ice conditions.

DAILY GAUGE HEIGHT AND DISCHARGE of Pinepound creek near Spring Coulee (Packard's farm), for 1916—*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.54	2.60	2.51	2.10	2.39	0.46	2.41	0.67
2	2.40	0.55	2.51	2.10	2.40	0.55	2.40	0.55
3	2.40	0.55	2.53	2.40	2.39	0.46	2.41	0.67
4	2.39	0.46	2.54	2.60	2.39	0.46	2.43	0.91
5	2.39	0.46	2.53	2.40	2.40	0.55	2.44	1.03
6	2.49	1.75	2.53	2.40	2.40	0.55	2.43	0.91
7	2.49	1.75	2.53	2.40	2.39	0.46	2.40	0.55
8	2.49	1.75	2.54	2.60	2.40	0.55	2.41	0.67
9	2.49	1.75	2.54	2.60	2.40	0.55	2.35	0.12
10	2.49	1.75	2.55	2.80	2.38	0.38	2.37	0.29
11	2.50	1.90	2.54	2.60	2.38	0.38	2.38	0.38
12	2.50	1.90	2.54	2.60	2.39	0.46	2.38	0.38
13	2.55	2.80	2.56	3.00	2.39	0.46	2.38	0.38
14	2.61	4.30	2.57	3.30	2.40	0.55	2.41	0.67
15	2.63	4.80	.....	1.03*e*	2.40	0.55	2.42	0.79
16	2.64	5.10	.....	0.48*e*	2.40	0.55	2.40	0.55
17	2.68	6.70	2.19	Nil	2.40	0.55	2.40	0.55
18	2.69	7.20	2.19	"	2.35	0.12	2.41	0.67
19	2.68	6.70	2.19	"	2.40	0.55	2.39	0.46
20	2.67	6.30	2.38	0.38	2.40	0.55	2.40	0.55
21	2.66	5.80	2.34	0.10	2.40	0.55	2.40	0.55
22	2.66	5.80	2.35	0.12	2.40	0.55	2.39	0.46
23	2.67	6.30	2.35	0.12	2.39	0.46	2.39	0.38
24	2.67	6.30	2.34	0.10	2.40	0.55	2.38	0.38
25	2.66	5.80	2.34	0.10	2.42	0.79	2.39	0.46
26	2.66	5.80	2.34	0.10	2.40	0.55	2.37	0.29
27	2.65	5.40	2.35	0.12	2.42	0.79	2.39	0.46
28	2.65	5.40	2.20	Nil	2.42	0.79	2.38	0.38
29	2.66	5.80	2.24	"	2.40	0.55	2.36	0.21
30	2.49	1.75	2.26	"	2.42	0.79	2.36	0.21
31	2.51	2.10	2.39	0.46	.....	.....	2.36	0.21

e Discharge estimated.

MONTHLY DISCHARGE of Pinepound creek near Spring Coulee (Packard's farm), for 1916

(Drainage area *x* square miles)

MONTH	DISCHARGE IN SECOND-FEET			RUN-OFF
	Maximum	Minimum	Mean	Total in Acre-feet
March (20-31)	25.00	5.00	13.70	326
April	15.60	1.60	5.40	321
May	8.60	1.45	3.20	197
June	12.40	2.80	6.60	393
July	7.20	0.46	3.80	234
August	3.30	Nil	1.26	77
September	0.79	0.12	0.54	32
October	1.03	0.12	0.51	31
The period	.....	.....	.....	1,611

x The greater portion of the discharge is waste water from the Alberta Railway and Irrigation Company's canal, so drainage area not computed nor applied.

ALBERTA RAILWAY AND IRRIGATION COMPANY'S CANAL AT SPRING COULEE

(From St. Mary River at Kimball)

Location.—On the NW. ¼ Sec. 28, Tp. 4, Rge. 23, W. 4th Mer.

Records available.—During irrigation seasons from May 1, 1914, to October 31, 1916.

Gauge.—Vertical staff; zero of gauge maintained at elevation 87.68 feet since establishment. Gauge read by D. M. Boyd.

Bench-mark.—Permanent iron bench-mark set 30 feet southwest of rod; assumed elevation 100.00 feet.

Channel.—Straight for 200 feet above and 100 feet below the cable. The banks are steep and high and the stream bed consists of sand, clay and small stone, liable to shift.

Discharge measurements.—Made from a temporary cable structure located 150 feet below the gauge.

Remarks.—Water turned into canal at Kimball, April 25. Gates closed at Kimball, October 7.

DISCHARGE MEASUREMENTS of Alberta Railway and Irrigation Company's canal at Spring Coulee, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 14	S. H. Frame				1.33	Nil
May 9	do	47.0	68.4	2.56	3.09	175
May 27	do	46.0	76.0	2.84	3.25	216
July 17	W. A. Burton	46.0	76.7	3.16	3.35	242
Aug. 21	S. H. Frame	46.0	76.0	3.23	3.31	246
Sept. 18	W. A. Burton	45.0	58.2	2.55	2.89	149
Oct. 9	S. H. Frame	41.0	25.4	0.82	1.95	21

DAILY GAUGE HEIGHT AND DISCHARGE of Alberta Railway and Irrigation Company's canal at Spring Coulee, for 1916

DAY	April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			3.01	159	3.02	174
2			3.02	161	3.02	174
3			3.07	171	3.00	170
4			3.05	167	2.09	36
5			3.07	171	2.10	37
6			3.05	167	2.09	36
7			3.06	170	2.09	36
8			3.05	167	3.00	170
9			3.09	175	3.00	170
10			3.09	177*s*	3.10	191
11			3.10	179	3.16	204
12			3.10	180	3.14	200
13			3.11	182	3.14	200
14			3.12	186	3.06	182
15			3.20	203	3.08	187
16			3.35	239	3.20	213
17			3.37	243	3.26	226
18			3.39	248	3.25	224
19			3.40	251	3.25	224
20			3.42	256	3.05	180
21			3.45	263	3.10	191
22			3.48	270	3.12	195
23			3.70	320	3.30	235
24			4.00	386	3.30	235
25			3.90	365	3.29	233
26			3.27	228*s*	3.30	235
27			3.25	224	3.30	235
28			3.22	217	3.32	239
29	2.70	107	3.24	222	3.32	239
30	2.76	116	3.25	224	3.33	242
31			3.00	170		

s-s Shifting conditions.

DAILY GAUGE HEIGHT AND DISCHARGE of Alberta Railway and Irrigation Company's canal at Spring Coulee, for 1916—*Concluded*

Day	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.32	239	3.36	248	3.31	237	2.87	145.00
2	3.34	244	3.36	248	3.30	235	2.86	143.00
3	2.98	166	3.37	250	3.59	299	2.92	154.00
4	2.98	166	3.36	248	3.59	299	2.95	160.00
5	2.98	166	3.36	248	3.53	286	2.93	156.00
6	3.25	224	3.36	248	.....	209e	2.89	148.00
7	3.25	224	3.36	248	2.80	132	2.79	130.00
8	3.25	224	3.36	248	2.85	141	2.74	122.00
9	3.25	224	3.36	248	2.85	141	1.95	21.00
10	3.26	226	3.37	250	2.85	141	1.96	22.00
11	3.23	220	3.36	248	2.85	141	1.78	6.40
12	3.26	226	3.36	248	2.85	141	1.70	Nil
13	3.25	224	3.37	250	2.85	141	1.70	"
14	3.24	222	3.36	248	2.85	141	1.69	"
15	3.24	222	3.37	250	2.85	141	1.70	"
16	3.23	220	3.38	253	2.85	141	1.69	"
17	3.35	246	3.38	253	2.85	141	1.69	"
18	3.36	248	3.37	250	2.89	148	1.71	0.80
19	3.36	248	3.36	248	2.89	148	1.71	0.80
20	3.36	248	3.30	235	2.89	148	1.72	1.60
21	3.35	246	3.31	237	2.88	146	1.72	1.60
22	3.34	244	3.30	235	2.87	145	1.73	2.40
23	3.35	246	3.31	237	2.87	145	1.73	2.40
24	3.35	246	3.31	237	2.89	148	1.72	1.60
25	3.36	248	3.31	237	3.01	172	1.72	1.60
26	3.35	246	3.30	235	3.04	178	1.71	0.80
27	3.36	248	3.31	237	3.05	180	1.69	Nil
28	3.35	246	3.30	235	3.05	180	1.67	"
29	3.35	246	3.31	237	3.04	178	1.63	"
30	3.36	248	3.31	237	3.04	178	1.52	"
31	3.36	248	3.31	237	.....	.....	1.48	"

e Discharge estimated.

MONTHLY DISCHARGE of Alberta Railway and Irrigation Company's canal at Spring Coulee, for 1916

Month	Discharge in Second-Feet			Run-Off
	Maximum	Minimum	Mean	Total Discharge in Acre-ft.
April (29-30)	116	107	112	444
May	386	159	217	13,343
June	242	36	184	10,949
July	248	166	230	14,142
August	253	235	244	15,003
September	299	132	173	10,294
October	160	Nil	39	2,398
The period	.....	.....	.....	66,573

POTHOLE CREEK NEAR MAGRATH (UPPER STATION)

Location.—On the NW. ¼ Sec. 10, Tp. 5, Rge. 22, W. 4th Mer., three and one-half miles south and one mile west of Magrath.

Records available.—April 27, 1914, to October 31, 1916.

Gauge.—Vertical staff. Zero of gauge maintained at elevation of 92.68 feet since establishment. Gauge read by L. A. Harrison.

Bench-mark.—Permanent iron bench-mark, located on the right bank thirty feet south of the staff gauge; assumed elevation 100.00 feet.

Channel.—Straight for about 100 feet above and 50 feet below gauge, composed of fine gravel and stones and liable to shift during floods.

Discharge measurements.—Made with current-meter by wading at low stages; by cable at high stages.

Winter flow.—Station discontinued during winter season.

Remarks.—A one-half inch steel cable was installed at this station in 1916.

DISCHARGE MEASUREMENTS of Pothole (Upper Station) creek near Magrath, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 20	S. H. Frame	30.5	22.0	2.51	1.94	56.0
April 13	do	19.0	10.6	1.79	1.32	18.5
May 10	do	17.0	5.8	0.60	0.98	3.5
May 27	W A. Burton	30.0	87.0	4.00	3.62	348.0*e*
June 8	S. H. Frame	24.0	19.2	2.53	1.65	48.0
July 18	W. A. Burton	22.5	11.3	1.81	1.41	20.0
Aug. 11	S. H. Frame	31.0	26.0	2.85	1.81	74.0
Aug. 30	W. A. Burton	8.0	3.1	2.13	1.08	6.6
Sept. 18	S. H. Frame	11.0	5.7	2.35	1.19	13.4
Oct. 13	do	27.0	31.6	0.93	1.36	29.0

e Discharge estimated by field inspection.

DAILY GAUGE HEIGHT AND DISCHARGE of Pothole (Upper Station) creek near Magrath, for 1916

DAY	February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	1.86	73.0	1.32	18.3	1.16	9.5	2.61	189.0
2	.....	.....	1.98	91.0	1.34	19.6	1.18	10.4	2.41	158.0
3	.....	.....	2.05	102.0	1.33	18.9	1.19	10.9	2.21	127.0
4	.....	.....	2.10	110.0	1.32	18.3	1.19	10.9	2.31	142.0
5	.....	.....	2.05	102.0	1.33	18.9	1.10	7.0	3.71	361.0
6	.....	.....	1.90	79.0	1.36	21.0	1.03	4.7	3.31	298.0
7	.....	.....	1.85	71.0	1.38	22.0	1.02	4.4	2.31	142.0
8	.....	.....	3.60	344.0	1.42	25.0	1.02	4.4	1.65	46.0
9	.....	.....	4.51	486.0	1.36	21.0	1.01	4.2	1.61	42.0
10	.....	.....	5.41	626.0	1.22	12.5	0.98	3.5	1.81	66.0
11	.....	.....	5.01	564.0	1.19	10.9	1.00	3.9	2.01	96.0
12	.....	.....	4.81	532.0	1.17	10.0	1.00	3.9	1.76	60.0
13	.....	.....	3.42	316.0	1.32	18.3	1.06	5.6	1.71	53.0
14	.....	.....	3.02	253.0	1.12	7.8	1.09	6.6	1.64	45.0
15	.....	.....	2.42	160.0	1.09	6.6	1.07	5.9	1.51	33.0
16	.....	.....	2.22	128.0	1.09	6.6	1.06	5.6	1.41	24.0
17	.....	.....	2.12	113.0	1.08	6.3	1.03	4.7	1.36	21.0
18	.....	.....	2.02	97.0	1.05	5.2	1.01	4.2	1.31	17.6
19	.....	.....	1.72	55.0	1.02	4.4	1.01	4.2	1.61	42.0
20	.....	.....	1.94	85.0	1.00	3.9	1.00	3.9	1.69	51.0
21	.....	.....	1.75	58.0	1.00	3.9	1.00	3.9	1.73	56.0
22	2.80	219	1.62	43.0	0.98	3.5	1.12	7.8	1.87	74.0
23	2.70	203	1.47	29.0	0.98	3.5	1.25	14.1	1.91	80.0
24	2.70	203	1.37	22.0	0.97	3.3	2.99	248.0	1.90	79.0
25	2.65	195	1.32	18.3	0.97	3.3	4.99	560.0	1.87	74.0
26	2.63	192	1.31	17.6	0.98	3.5	4.51	486.0	1.83	69.0
27	2.25	133	1.31	17.6	0.98	3.5	3.91	392.0	1.82	67.0
28	1.90	79	1.33	18.9	0.99	3.7	3.71	361.0	3.12	269.0
29	1.82	67	1.34	19.6	1.07	5.9	3.51	330.0	3.03	255.0
30	.....	.....	1.32	18.3	1.14	8.6	3.21	283.0	2.68	200.0
31	.....	.....	1.33	18.9	.....	.....	3.01	252.0	.....	.....

DAILY GAUGE HEIGHT AND DISCHARGE of Pothole (Upper Station) creek near Magrath, for 1916
—*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.12	113.0	0.93	2.50	1.07	5.9	1.10	7.0
2	2.10	110.0	0.93	2.50	1.30	17.0	1.20	11.4
3	1.99	92.0	0.90	2.00	3.40	312.0	1.20	11.4
4	1.86	73.0	0.89	1.86	4.00	406.0	1.25	14.1
5	1.75	58.0	0.86	1.44	4.15	429.0	1.35	20.0
6	1.62	43.0	0.86	1.44	4.00	406.0	1.35	20.0
7	1.82	67.0	0.85	1.30	3.20	281.0	1.30	17.0
8	1.70	52.0	0.83	1.10	3.00	250.0	1.25	14.1
9	1.61	42.0	2.02	97.00	2.50	172.0	1.36	21.0
10	1.52	34.0	4.03	411.00	2.10	110.0	1.34	19.6
11	1.49	31.0	2.46	166.00	1.75	58.0	1.32	18.3
12	1.42	25.0	2.16	119.00	1.40	24.0	1.30	17.0
13	1.36	21.0	1.63	44.00	2.00	94.0	1.36	21.0
14	1.32	18.3	1.56	37.00	1.80	65.0	1.27	15.3
15	1.29	16.4	1.44	27.00	1.60	41.0	1.26	14.7
16	1.26	14.7	1.33	18.90	1.40	24.0	1.25	14.1
17	1.17	10.0	1.38	22.00	1.30	17.0	1.25	14.1
18	1.41	24.0	1.39	23.00	1.19	10.9	1.26	14.7
19	1.23	13.0	1.41	24.00	1.25	14.1	1.24	13.6
20	1.21	11.9	1.39	23.00	1.20	11.4	1.24	13.6
21	1.19	10.9	1.38	22.00	1.15	9.0	1.25	14.1
22	1.19	10.9	1.37	22.00	1.15	9.0	1.27	15.3
23	1.17	10.0	1.36	21.00	1.12	7.8	1.27	15.3
24	1.15	9.0	1.35	20.00	1.12	7.8	1.26	14.7
25	1.19	10.9	1.34	19.60	1.10	7.0	1.26	14.7
26	1.15	9.0	1.29	16.40	1.10	7.0	1.25	14.1
27	1.11	7.4	1.18	10.40	1.10	7.0	1.26	14.7
28	1.05	5.2	1.14	8.60	1.10	7.0	1.27	15.3
29	1.03	4.7	1.14	8.60	1.10	7.0	1.28	15.8
30	0.99	3.7	1.08	6.30	1.10	7.0	1.29	16.4
31	0.97	3.3	1.10	7.00	.....	.....	1.30	17.0

MONTHLY DISCHARGE of Pothole (Upper Station) creek near Magrath, for 1916

(Drainage area 162 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
February (22-29)	219	67.00	161.0	0.994	0.30	2,554
March	626	17.60	151.0	0.932	1.07	9,285
April	25	3.30	10.6	0.065	0.07	631
May	560	3.50	99.0	0.611	0.70	6,087
June	361	17.60	108.0	0.667	0.74	6,426
July	113	3.30	31.0	0.191	0.22	1,906
August	411	1.10	38.0	0.235	0.27	2,337
September	429	5.90	94.0	0.580	0.65	5,593
October	21	7.00	15.5	0.096	0.11	953
The period	.....	.....	.....	.....	4.13	35,772

POTHOLE CREEK NEAR MAGRATH (LOWER STATION)

Location.—On the NE. ¼ Sec. 1, Tp. 6, Rge. 22, W. 4th Mer., three miles northeast of Magrath.

Records available.—April 28, 1914, to October 31, 1916.

Gauges.—Vertical staff; from April 28, 1914, to June 7, 1916. Open chain gauge from June 7, 1916, to date. On July 13, 1914, the gauge was moved 336 feet down stream from original location. From April 28, 1914, to July 13, 1914, zero of gauge was maintained at 92.87 feet and from July 13, 1914, to date, it has been maintained at 93.42 feet.

Bench-mark.—Permanent iron bench-mark located on the left bank, 50 feet from the staff; assumed elevation 100.00 feet.

Channel.—Composed of sand, gravel and clay, liable to shift during floods.

Discharge measurements.—Made with current-meter, by wading at low stages and from cable at high stages.

Floods.—Caused by overflow from Alberta Railway and Irrigation Company's canal.

Winter flow.—Station is not maintained during winter season.

Observers.—From February 28 to March 31, R. Hyden. From April 1 to May 30, F. Howes. From June 1 to June 30, R. Hyden. From July 1 to October 31, John Brown.

DISCHARGE MEASUREMENTS of Pothole (Lower Station) creek near Magrath, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 20	S. H. Frame	48.0	36.7	2.26	2.23	83.0
April 13	do	33.0	15.7	1.38	1.72	22.0
May 10	do	49.0	34.4	2.20	2.25	76.0
May 27	W. A. Burton	50.0	140.0	4.29	4.00	600.0e
June 7	S. H. Frame	57.0	61.4	2.38	2.73	145.0
July 18	W. A. Burton	58.0	65.7	2.17	2.74	143.0
Aug. 11	S. H. Frame	70.0	96.6	2.84	3.08	275.0
Aug. 30	W. A. Burton	61.0	53.4	2.17	2.56	116.0
Sept. 18	S. H. Frame	51.0	35.2	1.83	2.16	64.0
Oct. 13	do	45.0	28.2	1.51	1.90	43.0

e Discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of Pothole (Lower Station) creek near Magrath, for 1916

DAY	February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	1.86	3.0*e*	1.90	37.0	.....	70.0*e*	3.35	278
2	.....	.....	.....	3.0*e*	1.90	37.0	2.18	66.0	3.35	278
3	.....	.....	1.86	2.0	1.90	37.0	2.20	68.0	.....	230*e*
4	.....	.....	1.86	2.0	.....	37.0*e*	2.25	74.0	.....	190
5	.....	.....	.....	2.0*e*	1.90	37.0	.....	74.0*e*	2.80	154
6	.....	.....	1.36	3.0	1.85	32.0	2.25	74.0	3.60	353
7	.....	.....	1.36	3.0	.....	32.0*e*	.....	72.0*e*	2.73	142
8	.....	.....	.....	10.0*e*	1.85	32.0	2.23	71.0	.....	105*e*
9	.....	.....	1.86	30.0	.....	30.0*e*	2.23	71.0	2.20	68
10	.....	.....	....*b*	80.0*e*	1.80	28.0	2.25	74.0	.....	80*e*
11	.....	.....	3.76	408.0	1.80	28.0	2.25	74.0	2.40	93
12	.....	.....	.....	408.0*e*	.....	25.0*e*	.....	75.0*e*	2.67	132
13	.....	.....	3.76	408.0	1.72	22.0	2.27	76.0	2.55	113
14	.....	.....	2.11	58.0	.....	18.0*e*	2.25	74.0	.....	100*e*
15	.....	.....	.....	50.0*e*	1.60	14.0	2.20	68.0	2.36	88
16	.....	.....	1.96	43.0	.....	14.0*e*	.....	55.0*e*	.....	88*e*
17	.....	.....	.....	38.0*e*	1.60	14.0	1.95	42.0	2.36	88
18	.....	.....	1.86	33.0	.....	14.0*e*	2.07	54.0	.....	62*e*
19	.....	.....	.....	52.0*e*	1.60	14.0	.....	48.0*e*	1.90	37
20	.....	.....	2.23	71.0	1.60	14.0	1.95	42.0	.....	52*e*
21	.....	.....	.....	69.0*e*	1.50	8.0	1.70	21.0	2.20	68
22	.....	.....	2.20	68.0	1.50	8.0	2.10	57.0	2.40	93
23	.....	.....	2.20	68.0	.....	8.0*e*	2.45	99.0	2.35	86
24	.....	.....	.....	57.0*e*	1.50	8.0	.....	270.0*e*	.....	88*e*
25	.....	.....	2.00	46.0	1.50	8.0	3.85	441.0	.....	90*e*
26	.....	.....	.....	44.0*e*	1.45	5.6	4.80	900.0	2.40	93
27	.....	.....	1.95	42.0	1.50	8.0	4.00	503.0	2.72	140
28	2.11*b*	1.0*e*	1.90	37.0	.....	28.0*e*	.....	324.0*e*	5.60	1,300
29	.....	2.0*e*	.....	42.0*e*	.....	60.0*e*	2.75	145.0	3.55	337
30	.....	.....	2.00	46.0	2.35	86.0	.....	146.0*e*	.....	330*e*
31	.....	.....	1.90	37.0	.....	.....	2.76	147.0	.....	.....

b-b Ice conditions from Feb. 28 to Mar. 10.
e Discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of Pothole (Lower Station) creek near Magrath, for 1916
—*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	284*e*	2.58	148	2.50	106	1.97	44.0
2	.....	238*e*	2.61	155	3.63	363	1.99	46.0
3	3.00	193	2.62	158	3.70	387	2.86	165.0
4	3.17	232	2.68	171	4.00	503	2.87	167.0
5	3.06	206	2.52	144	3.60	353	2.76	147.0
6	2.97	187	2.48	138	3.50	321	2.75	145.0
7	2.98	189	2.49	140	2.98	189	2.67	132.0
8	3.01	196	2.33	116	2.60	121	2.66	130.0
9	2.96	185	4.20	720	2.70	137	2.24	73.0
10	3.02	198	3.33	346	3.66	373	2.04	51.0
11	2.99	191	3.08	375	3.70	387	1.94	41.0
12	2.90	173	3.09	278	3.80	422	1.92	39.0
13	2.87	167	2.80	204	3.75	404	1.90	37.0
14	2.72	140	2.80	203	3.60	353	1.80	28.0
15	2.63	125	2.68	177	2.70	137	1.89	36.0
16	2.98	189	2.51	144	2.65	128	1.81	29.0
17	2.56	115	2.63	164	2.70	137	1.97	44.0
18	2.74	143	2.98	238	2.16	64	1.84	32.0
19	2.84	164*s*	2.80	195	2.73	142	1.80	28.0
20	2.54	116	2.70	172	2.31	81	1.82	30.0
21	2.62	132	2.70	170	2.13	60	1.79	27.0
22	2.30	88	2.73	172	2.11	58	1.93	40.0
23	2.40	103	2.65	155	2.00	46	1.95	42.0
24	2.42	108	2.70	162	2.06	53	1.92	39.0
25	2.46	116	2.60	141	2.13	60	1.89	36.0
26	2.51	126	2.70	155	2.14	61	1.78	27.0
27	2.76	172	2.60	134	2.10	57	1.94	41.0
28	2.71	164	2.63	134	2.07	54	1.73	23.0
29	2.60	146	2.60	126	2.16	64	1.64	16.6
30	2.63	153	2.56	116*s*	2.05	52	1.79	27.0
31	2.61	152	2.53	111	.....	.....	1.56	11.4

s-s Shifting conditions.

MONTHLY DISCHARGE of Pothole (Lower Station) creek near Magrath, for 1916

MONTH	DISCHARGE IN SECOND-FEET			RUN-OFF
	Maximum	Minimum	Mean	Total in Acre-feet
February (28-29)	2	1.0	1.5	6
March	408	2.0	73.0	4,489
April	86	5.6	25.0	1,488
May	900	21.0	141.0	8,670
June	1,300	37.0	179.0	10,651
July	284	88.0	164.0	10,084
August	720	111.0	192.0	11,806
September	503	46.0	189.0	11,246
October	167	11.4	57.0	3,505
The period	.....	.....	.....	61,945

x Owing to the greater part of the discharge being waste water from the Alberta Railway and Irrigation Company's canal, the drainage area has not been taken out.

ST. MARY RIVER AT WHITNEY'S RANCH

Location.—On the NE. ¼ Sec. 26, Tp. 7, Rge. 22, W. 4th Mer.

Records available.—October 13, 1911, to December 31, 1915.

Gauge.—Vertical staff. Zero of gauge maintained at 87.55 feet during 1911. Zero of gauge maintained at 89.13 feet during 1912. Zero of gauge maintained at 89.15 feet during 1913-16.

A Stevens Type B, Continuous Water Stage Recorder with same datum as the staff gauge was used from June 8, to November 14, 1916.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet, located near Mr. Whitney's house.

Channel.—Consists of gravel and is liable to shift.

Discharge measurements.—Made from a cable car, located about 2,000 feet down stream from the gauge.

Winter flow.—Obtained through the ice, 240 feet down stream from the cable.

Observer.—W. D. Whitney.

DISCHARGE MEASUREMENTS of St. Mary river at Whitney's ranch, in 1916.

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 5	W. H. Storey	120	226	0.65	1.84*b*	148
Feb. 2	V. A. Newhall	105	144	1.06	1.96*b*	153
Feb. 21	H. W. Rowley	265	515	4.02	2.22	2,072
Mar. 10	do	240	614	2.70	2.16	1,659
Mar. 27	J. M. Paul	203	310	2.79	1.45	866
April 28	do	202	304	2.91	1.44	886
May 17	W. M. Edwards	245	434	3.40	1.85	1,561
June 15	do	300	818	4.73	2.77	3,865
June 22	J. E. Degnan	381	1,420	6.26	3.97	8,887
June 24	do	378	1,323	5.96	3.66	7,889
June 27	do	375	1,208	5.54	3.38	6,687
July 17	W. M. Edwards	318	799	4.22	2.60	3,370
Aug. 14	do	261	443	3.11	1.84	1,377
Sept. 11	do	221	416	3.17	1.80	1,319
Oct. 6	J. R. Estey	195	239	2.40	1.27	571
Oct. 21	E. J. Switzer	132	187	2.55	1.17	478
Nov. 14	W. M. Edwards	184	131	1.74	1.29*b*	227
Dec. 7	H. W. Rowley	80	98	1.66	1.06*b*	163
Dec. 28	do	127	207	0.87	1.54*b*	179

b Ice conditions.

DAILY GAUGE HEIGHT AND DISCHARGE of St. Mary river at Whitney's ranch, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.60*b*	135	1.62	152	1.05	210	1.50	912	1.50	912	2.50	3,008
2	1.70	130	1.96	153	1.05	210	1.53	955	1.55	984	2.50	3,008
3	1.75	132	1.96	154	1.07	210	1.55	984	1.65	1,131	2.55	3,159
4	1.85	140	2.02	158	1.03	180	1.55	984	1.75	1,296	2.55	3,159
5	1.85	148	2.02	160	1.50	680	1.53	955	1.85	1,476	2.57	3,219
6	1.88	154	2.02	162	1.35	480	1.50	912	1.90	1,568	2.60	3,310
7	1.88	157	2.07	165	1.50	660	1.50	912	2.00	1,770	2.60	3,310
8	1.90	160	2.12	169	1.60	780	1.47	872	2.10	1,990	2.54*x*	3,129
9	1.90	160	2.17	174	1.70	900	1.47	872	2.20	2,215	2.54	3,129
10	1.90	160	2.22	179	2.73	1,660	1.45	845	2.30	2,460	2.61	3,344
11	1.90	160	2.27	183	2.73	1,700	1.43	818	2.25	2,338	2.83	4,116
12	1.91	160	2.27	190	2.57	1,600	1.43	818	2.25	2,338	2.89	4,346
13	1.91	160	2.37	200	2.47	1,600	1.43	818	2.22	2,264	2.81	4,038
14	1.91	160	4.02*bg*	800*s*	2.22	1,200	1.42	805	1.95	1,669	2.78	3,930
15	1.90	158	4.17	1,200*s*	1.72	900	1.42	805	1.87	1,513	2.78	3,930
16	1.90	157	4.02	1,200*s*	1.67	800	1.42	805	1.87	1,513	2.88	4,308
17	1.85	157	.....*g*	2,000*e*	1.65	800	1.42	805	1.83	1,440	3.04	4,956
18	1.83	156	.....	1,800*e*	1.62	750	1.42	805	1.85	1,476	3.24	5,818
19	1.80	155	.....	2,000*e*	1.62	750	1.43	818	1.90	1,568	3.46	6,816
20	1.75	154	.....	2,000*e*	1.57	700	1.43	818	1.90	1,568	3.67	7,808
21	1.68	154	2.22	2,072*d*	1.57	700	1.45	845	1.95	1,669	3.80	8,433
22	1.65	154	2.10	1,600*s*	1.57	700	1.45	845	1.95	1,669	3.91	8,964
23	1.63	154	1.85	1,200	1.57	700	1.47	872	2.00	1,770	.....	8,362*e*
24	1.60	154	1.80	1,020	1.52	650	1.47	872	2.10	1,990	3.66	7,760
25	1.57	153	1.52	780	1.52	650	1.46	858	2.30	2,460	3.43	6,678
26	1.57	152	1.50	760	1.82	900*s*	1.46	858	2.60	3,310	3.27	5,952
27	1.55	152	1.82	900	1.45	845	1.46	858	2.45	2,864	3.27	5,952
28	1.52	151	1.05	220	1.45	845	1.44	832	2.45	2,864	3.36	6,358
29	1.47	151	1.03	200	1.47	872	1.45	845	2.45	2,864	3.70	7,950
30	1.47	151	.....	.....	1.47	872	1.45	845	2.45	2,864	3.71	7,998
31	1.47	151	.....	.....	1.50	912	.....	.....	2.47	2,922	.....	.....

b-b Ice conditions.
g Ice going out, February 14 to February 17.
x Automatic gauge heights from June 8 to November 7.
d Actual measurement.
s Shifting conditions, February 22 to March 26.
e Discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of St. Mary river at Whitney's ranch, for 1916.—*Concluded.*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.60	7,475	2.00	1,770	1.57	1,012	1.25	588	1.09	408	1.35	195
2	3.41	6,586	2.01	1,792	1.56	998	1.23	564	1.09	408	1.33	190
3	3.40	6,540	2.02	1,814	1.60	1,055	1.23	564	1.08	397	1.34	185
4	3.41	6,586	2.05	1,880	1.80	1,385	1.25	588	1.10	418	1.34	180
5	3.36	6,358	2.06	1,902	1.76	1,314	1.25	588	1.12	440	1.25	175
6	3.30	6,085	2.08	1,946	1.75	1,296	1.27	612	1.13	451	1.20	169
7	3.20	5,640	2.12	2,035	1.77	1,332	1.30	648	1.11*x*	429	1.06	163
8	3.10	5,205	2.15	2,102	1.78	1,350	1.32	674	1.00	315	1.15	161
9	3.04	4,956	1.88	1,531	1.79	1,367	1.29	636	1.00	315	1.12	160
10	3.00	4,798	1.70	1,208	1.80	1,385	1.26	600	0.99	305	1.12	159
11	2.98	4,709	1.74	1,279	1.80	1,385	1.24	576	0.99	305	1.10	158
12	2.96	4,628	1.80	1,385	1.75	1,296	1.24	576	.....	415*e*	1.10	158
13	2.93	4,506	1.80	1,385	1.71	1,226	1.22	552	.....	525*e*	1.09	157
14	2.90	4,385	1.84	1,458	1.66	1,147	1.20	528	1.29	636	1.09	156
15	2.89	4,346	1.81	1,403	1.62	1,086	1.19	517	1.35	713	1.07	156
16	2.76	3,860	1.76	1,314	1.59	1,041	1.16	484	1.40	778	1.06	155
17	2.63	3,412	1.74	1,279	1.57	1,012	1.16	484	1.40	778	1.06	154
18	2.65	3,480	1.75	1,296	1.54	969	1.17	495	1.40	778	1.06	155
19	2.60	3,310	1.75	1,296	1.51	926	1.17	495	1.50	912	1.05	156
20	2.53	3,099	1.76	1,314	1.47	872	1.15	473	1.55	984	1.05	156
21	2.46	2,893	1.75	1,296	1.45	845	1.17	495	1.60*b*	215	1.04	157
22	2.38	2,668	1.72	1,243	1.43	818	1.21	540	1.53	215	1.04	159
23	2.33	2,538	1.69	1,193	1.40	778	1.28	624	1.50	214	1.04	160
24	2.29	2,436	1.65	1,131	1.38	752	1.25	588	1.47	212	1.62	165
25	2.23	2,288	1.61	1,070	1.36	726	1.24	576	1.46	210	1.60	168
26	2.18	2,170	1.59	1,041	1.33	687	1.19	517	1.45	208	1.59	171
27	2.15	2,102	1.58	1,026	1.32	674	1.16	484	1.45	207	1.57	175
28	2.14	2,080	1.58	1,026	1.32	674	1.16	484	1.43	204	1.58	179
29	2.11	2,012	1.58	1,026	1.30	648	1.16	484	1.40	202	1.58	187
30	2.07	1,924	1.58	1,026	1.28	624	1.14	462	1.38	199	1.58	190
31	2.03	1,836	1.58	1,026	.....	.....	1.11	429	.....	.....	1.58*b*	193

x Automatic gauge records from June 8 to November 7.
b-b Ice conditions.

MONTHLY DISCHARGE of St. Mary river at Whitney's ranch, for 1916

(Drainage area 1,394 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	160	130	153	0.110	0.13	9,408
February	2,000	152	757	0.543	0.59	43,543
March	1,700	180	820	0.588	0.68	50,420
April	984	805	862	0.618	0.69	51,293
May	3,310	912	1,959	1.400	1.61	120,425
June	8,964	3,008	5,208	3.740	4.17	309,824
July	7,475	1,836	4,029	2.890	3.33	247,674
August	2,102	1,026	1,403	1.010	1.16	86,246
September	1,385	624	1,023	0.734	0.82	60,858
October	674	429	546	0.392	0.45	33,572
November	984	199	427	0.306	0.34	25,408
December	195	154	168	0.121	0.14	10,330
The year	.....	.....	.....	.....	14.11	1,049,001

MEAN MONTHLY DISCHARGE of St. Mary river at Whitney's ranch

(Area of watershed 1,394 square miles)

(Average run-off per square mile 526.7 acre-feet)

YEAR	Jan. Sec.-ft.	Feb. Sec.-ft.	Mar. Sec.-ft.	April Sec.-ft.	May Sec.-ft.	June Sec.-ft.	July Sec.-ft.	Aug. Sec.-ft.	Sept. Sec.-ft.	Oct. Sec.-ft.	Nov. Sec.-ft.	Dec. Sec.-ft.	Total Acre-ft.
1911										535*b*	730	215	*76,820a*
1912	263	212	134*b*	949*b*	1,977	2,074	1,723	867	433	479	523	271	593,327
1913	88	108	201	1,224	2,002	4,163	1,859	942	339	532	538	197	736,631
1914	191	129	336	799	1,851	1,790	992	386	318	1,067	889	203	542,074
1915	180	186	897	705	1,744	2,744	1,959	1,054	909	934	739	326	749,550
1916	153	757	820	862	1,959	5,208	4,029	1,403	1,023	546	427	168	1,049,001
Average Sec.-ft.	175	278	478	908	1,906	3,196	2,112	930	604	682	641	230	734,116
Average Acre-ft.	10,760	15,439	29,391	54,030	117,195	190,175	129,862	57,185	35,940	41,935	38,142	14,142	734,196

a Not included in average.
b Reduced to monthly average.

MILK RIVER DRAINAGE BASIN

General Description

Milk river rises on the eastern slope of the foot-hills on the Blackfoot Indian Reserve in the United States. Its headwaters run down in two main streams, which are known, after entering Canada, as the north and south branches.

The north branch flows in a northeasterly direction through the Blackfoot Reserve for a distance of about fifteen miles, and then enters Canada near the quarter mound on the south side of Section 3, Township 1, Range 23, West of the 4th Meridian. From the international boundary the stream continues in a northeasterly direction for about nine miles, when it bends to the east and runs in an easterly direction through the second tier of townships to its junction with the south branch at the centre of Section 20, Township 2, Range 18, West of the 4th Meridian.

The south branch runs to the south and east of, and parallels the north branch for a distance of about forty-eight miles, as the crow flies, through the Blackfoot Reserve, and then enters Canada near the quarter mound on the south side of Section 1, Township 1, Range 20, West of the 4th Meridian. From the international boundary it flows in a northeasterly direction to its junction with the north branch.

From the confluence of the two branches, Milk river flows in an easterly direction through the second tier of townships in Canada to the east boundary of Range 7. From this point the river flows in a southeasterly direction to its first point of crossing the international boundary into the United States. This first point of crossing is near the quarter mound on the south side of Section 3, Township 1, Range 5, West of the 4th Meridian. From this point the river meanders in an easterly direction through Canada and the United States, to a point on the international boundary, about 900 feet west of the east boundary of Section 1, Township 1, Range 5, West of the 4th Meridian, where it finally crosses into the United States. This point is known as the "Eastern Crossing." The length of the course of the Milk river in Canada from the western crossing of the north branch to the eastern crossing is 179 miles. The length of the course of the south branch in Canada is 14 miles.

Throughout its course in Canada, from the western crossing of the north branch to the eastern crossing, Milk river flows through a well-defined valley, bordered on the east side by a range of hills. The whole of its watershed in Canada is treeless prairie land, the last 40 miles of river flat being, however, well wooded. The river receives a number of small tributary creeks along its course, all of which discharge a considerable volume of water during the spring freshets; usually they all dry up about July 1, and have no discharge again until late in the fall, when some of them have a small flow for perhaps a month before the freeze-up.

The general conditions of flow in the river are such as are typical of all rivers which have a watershed devoid of tree growth; that is, it is subject to extreme floods during the freshet period, and to correspondingly low flow during the summer months. From its headwaters to the "Eastern Crossing" the total area of the watershed of Milk river is 2,514 square miles. Of this total amount 1,627 miles are in Canada and 887 square miles in the United States.

NORTH BRANCH OF MILK RIVER AT PETERS' RANCH

Location.—On the NE. ¼ Sec. 11, Tp. 1, Rge. 23, W. 4th Mer.

Records available.—July 21, 1909, to December 31, 1916.

Gauges.—Friez automatic water-stage register used during open water. Vertical staff and open chain gauge installed September, 1916, used during ice conditions. Zero of gauges maintained at elevation 4,089.57 feet during 1913-16. Previous elevation of 4,110.45 in error. Gauge read by William Wheeler.

Bench-mark.—Permanent iron bench-mark; elevation 4,095.99 above mean sea-level (Irrigation surveys, 1915 datum). Previous elevation 4,116.87 in error.

Channel.—Bed not liable to shift. Clay banks likely to wash and change section and control.

Discharge measurements.—At low stages, from foot-bridge 700 feet below gauge, and at flood periods from cable car, two miles below.

Winter flow.—Obtained through the ice at foot-bridge.

Accuracy.—Stage-discharge relation permanent except during period of high water and ice; this condition necessitated frequent gaugings. By means of these measurements a rating curve fairly well defined, was drawn to represent average conditions. The operation of the Friez water stage register in use from April 6 to November 10, was satisfactory, except short period indicated by break in records, as shown in footnote to daily discharge table. Under ice conditions gauge read daily to one one-hundredth of a foot. Daily discharge ascertained by applying mean daily gauge height to rating table from April 26 to May 24, and from June 27 to August 19. Bolster method used from March 14 to April 25, May 25 to June 27, August 20 to November 10. Daily discharge during ice conditions ascertained from hydrograph derived from mean daily gauge height, discharge measurements and temperatures.

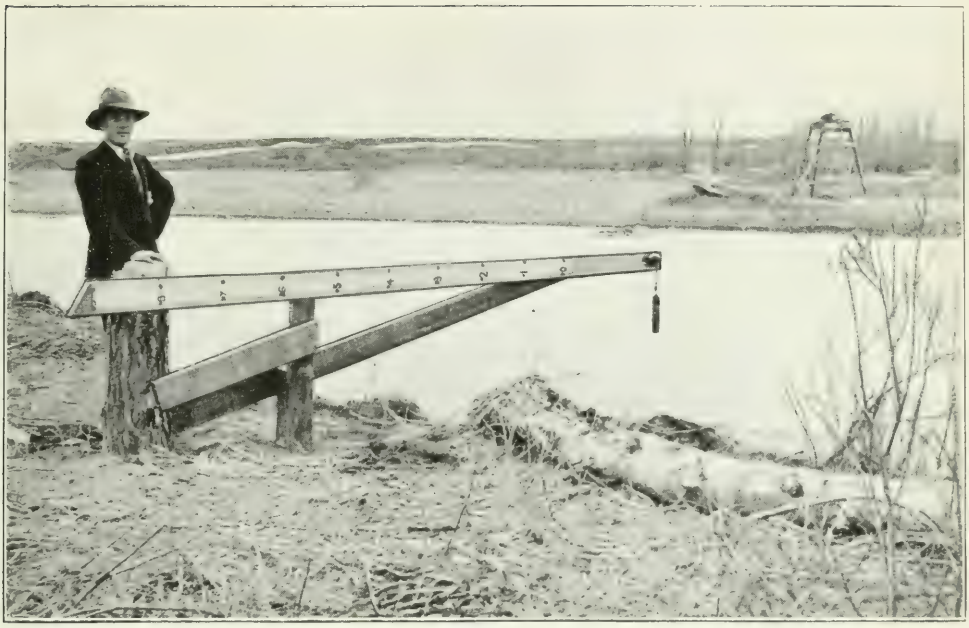
Remarks.—Amount of water reaching North Branch of Milk river from United States Reclamation Service's St. Mary canal during 1916 was 1,528 acre-feet.

DISCHARGE MEASUREMENTS of North branch of Milk river at Peters' ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 11	W. H. Storey	21.5	27.4	1.18	3.09*b*	32.0
Feb. 11	V. A. Newhall	16.0	17.4	0.32	3.57	5.5*e*
Mar. 2	do	42.0	69.2	0.52	3.11*b*	36.0
Mar. 16	S. H. Frame	46.0	49.9	1.82	2.45	91.0
April 6	do	45.5	39.2	1.90	2.30	74.0
April 25	do	43.0	33.6	1.73	2.07	58.0
April 26	W. A. Lamb (U.S.G.S.)	35.0	38.0	1.45	2.10	55.0
May 24	do do	42.0	50.0	2.12	2.45	106.0
May 31	S. H. Frame	46.0	49.1	2.02	2.45	99.0
June 1	do	22.5	61.2	2.94	2.84	180.0
June 11	A. H. Tuttle (U.S.G.S.)	22.0	58.0	3.14	2.90	182.0
June 21	S. H. Frame	21.0	51.9	2.00	2.44	103.0
June 27	do	21.0	52.9	2.27	2.47	120.0
June 27	A. H. Tuttle (U.S.G.S.)	22.0	45.0	2.24	2.50	104.0
June 28	S. H. Frame	22.0	75.9	3.34	3.32	267.0
July 19	W. A. Lamb (U.S.G.S.)	43.0	40.8	1.75	2.23	72.0
July 23	W. A. Burton	22.0	45.4	1.38	2.13	62.0
Aug. 19	V. A. Newhall	22.0	47.7	1.94	2.38	92.0
Sept. 5	S. H. Frame	22.0	50.0	2.02	2.38	101.0
Sept. 6	do	22.0	46.3	1.72	2.28	80.0
Sept. 7	do	22.0	45.8	1.59	2.21	73.0
Sept. 7	do	25.5	51.9	1.34	2.27	71.0
Sept. 27	do	22.0	40.8	1.44	2.19	59.0
Sept. 28	do	22.0	39.2	1.31	2.14	52.0
Nov. 15	do	22.0	38.1	1.38	2.49*b*	53.0
Nov. 16	do	22.0	38.1	1.43	2.41	55.0
Dec. 12	H. W. Rowley	22.0	34.6	1.17	2.36*b*	41.0

b Ice conditions from Jan. 1 to Mar. 13; Nov. 11 to Dec. 31.
e Discharge estimated, by field inspection.

PLATE 11



Open chain gauge used on Waterton river, near Stand Off.
Taken on April 4, 1916, by S. H. Frame.

PLATE 12

Bridge used for making gaugings of the North Branch of the Milk river at Peters' ranch.
Taken on September 28, 1916, by S. H. Frame.

DAILY GAUGE HEIGHT AND DISCHARGE of North branch of Milk river, at Peters' ranch, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.20*bx*	34.0	3.77	18.3	3.54	93	2.36	81	2.25	74	2.72	158
2	3.28	34.0	3.65	16.6	3.11	36	2.35	80	2.35	88	2.66	145
3	3.19	34.0	3.58	15.0	2.85	37	2.37	83	2.25	74	2.40	96
4	3.14	33.0	3.64	13.6	2.74	40	2.22	63	2.17	63	2.33	84
5	2.99	33.0	3.56	12.0	2.79	43	2.16*x*	57	2.16	62	2.69	149
6	2.87	33.0	.....	10.4*e*	2.73	46	2.30	74	2.11	56	2.75	159
7	2.61	33.0	3.86	9.0	2.75	51	2.34	80	2.10	55	2.45	102
8	3.03	33.0	3.74	8.0	2.94	64	2.34	81	2.08	53	2.38	88
9	3.08	32.0	3.91	7.0	4.30	83	2.39	90	2.06	51	2.36	84
10	.....	32.0*e*	.....	6.1*e*	5.11	104	2.42	96	2.02	47	2.71	148
11	3.09	32.0	3.57	5.5	4.64	123	2.38	90	2.02	47	2.83	169
12	3.18	32.0	3.45	53.0	3.34	144	2.43	100	2.08	53	2.46	101
13	3.22	32.0	3.86	110.0	.....*b*	164*e*	2.44	103	2.10	55	2.36	84
14	3.23	32.0	4.43	160.0	2.98	189	2.37	91	2.11	56	2.34	82
15	3.26	31.0	5.27	165.0	2.79	154	2.25	73	2.05	50	2.29	75
16	.....	31.0*e*	.....	169.0*e*	2.45	91	2.33	86	2.15	61	2.27	73
17	3.26	31.0	7.35	171.0	2.39	82	2.32	85	2.06*x*	51	2.25	71
18	3.24	31.0	7.26	174.0	2.20	58	2.29	82	2.05	50	2.22	68
19	3.32	30.0	6.52	178.0	2.37	80	2.28	81	2.04	49	2.31	80
20	3.21	31.0	4.25	180.0	2.50	102	2.22	73	2.05	50	2.36	88
21	2.93	32.0	3.95	178.0	2.49	100	2.16	66	2.03	48	2.42	100
22	3.10	34.0	3.75	176.0	2.34	76	2.17	68	2.00	45	2.48	110
23	3.25	35.0	3.55	173.0	2.23	62	2.14	65	2.22	70	2.56	125
24	.....	34.0*e*	3.54	169.0	2.15	54	2.10	61	2.45	106	2.30	80
25	3.66	32.0	3.02	165.0	2.14	53	2.07	58	.....	166*e*	2.37	90
26	3.72	30.0	2.55	160.0	2.21	61	2.11	56	3.10	225	2.39	94
27	3.33	29.0	2.42	154.0	2.27	68	2.57	128	2.85	178	2.46	108
28	.....	27.0*e*	2.20	147.0	2.17	57	2.58	130	2.65	140	3.18	241
29	3.66	25.0	3.12	140.0	2.08	48	2.10	55	....	158*e*	3.03	214
30	3.72	22.0	.....	.....	2.10	50	2.09	54	2.85	175	2.75	162
31	3.76	20.0	.....	.....	.....	65*e*	.....	.....	2.45*x*	99	.....	.....

b-b Ice conditions.
e Discharge estimated.
x Outside gauge. Jan. 1 to April 5; May 17 to May 30; Nov. 11 to Dec. 31.
Automatic gauge, April 6 to May 16; May 31 to Nov. 10.

DAILY GAUGE HEIGHT AND DISCHARGE of North branch of Milk river at Peters' ranch, for 1916
—*Concluded*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.43	102	2.11	56	2.25	78	2.15	53	2.15	53	.....	49.0*e*
2	2.38	93	2.11	56	2.25	78	2.18	56	2.17	55	2.11	48.0
3	2.40	96	2.11	56	2.76	170	2.18	56	2.16	54	2.12	48.0
4	2.34	86	2.12	57	3.08	230	2.21	59	2.15	53	2.10	47.0
5	2.28	78	2.15	61	2.49	122	2.26	65	2.15	53	2.18	47.0
6	2.27	76	2.13	58	2.29	82	2.37	80	2.12	50	2.20	47.0
7	2.25	74	2.13	58	2.27	76	2.37	80	2.16	54	2.13	47.0
8	2.28	78	2.18	64	2.26	75	2.25	64	2.38	81	2.35	46.0
9	2.28	78	2.73	158	2.24	72	2.21	60	2.18	56	2.43	45.0
10	2.23	71	2.62	137	2.26	74	2.22	60	2.06	44	2.38	44.0
11	2.18	64	2.44	104	2.21	67	2.24	63	2.23*xb*	46	2.36	42.0
12	2.18	64	2.32	83	2.18	63	2.23	62	2.24	48	2.36	41.0
13	2.19	66	2.42	100	2.22	67	2.20	58	.....	50*e*	2.38	40.0
14	2.18	64	2.39	95	2.31	79	2.16	54	.....	52*e*	2.25	40.0
15	2.14	60	2.25	74	2.28	75	2.15	53	2.49	53	2.33	38.0
16	2.12	57	2.22	70	2.25	70	2.15	53	2.41	55	2.37	37.0
17	2.18	64	2.31	82	2.21	65	2.18	56	2.37	56	2.45	36.0
18	2.27	76	2.60	134	2.20	63	2.23	62	2.42	56	2.41	35.0
19	2.25	74	2.38	93	2.18	61	2.24	63	2.37	56	2.38	34.0
20	2.22	70	2.30	80	2.17	59	2.31	72	2.10	56	2.41	32.0
21	2.18	64	2.30	80	2.17	59	2.39	85	.....	56*e*	2.50	30.0
22	2.16	62	2.29	79	2.16	57	2.31	72	.....	56*e*	2.53	28.0
23	2.13	58	2.27	77	2.16	57	2.22	60	.....	56*e*	2.51	26.0
24	2.16	62	2.31	82	2.14	55	2.21	60	2.02	56	2.52	24.0
25	2.19	66	2.33	86	2.10	50	2.19	57	2.22	55	2.53	21.0
26	2.25	74	2.33	87	2.11	51	2.19	57	2.12	54	2.51	19.0
27	2.44	104	2.30	83	2.18	58	2.22	60	2.05	54	2.52	17.0
28	2.28	78	2.29	82	2.15	53	2.19	57	2.09	53	2.49	15.2
29	2.15	61	2.29	82	2.14	52	2.16	54	.....	52*e*	2.41	13.8
30	2.10	55	2.30	84	2.13	51	2.15	53	.....	51*e*	2.47	15.0
31	2.10	55	2.27	80	.....	.....	2.17	55	.....	.....	2.20*b*	17.0

b-b Ice conditions, Nov. 11 to Dec. 31.
e Discharge estimated.
x Outside gauge, Jan. 1 to April 15; May 17 to May 30; Nov. 11 to Dec. 31.
Automatic gauge, April 6 to May 16; May 31 to Nov. 10.

MONTHLY DISCHARGE of North branch of Milk river at Peters' ranch, for 1916

(Drainage area 101 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	35	20.0	31	0.307	0.35	1,906
February	180	5.5	102	1.010	1.09	5,867
March	189	36.0	80	0.792	0.91	4,919
April	130	54.0	80	0.792	0.88	4,760
May	225	45.0	82	0.812	0.94	5,042
June	241	68.0	114	1.130	1.26	6,783
July	104	55.0	72	0.713	0.82	4,427
August	158	56.0	83	0.822	0.95	5,103
September	230	50.0	76	0.752	0.84	4,522
October	85	53.0	61	0.604	0.70	3,751
November	81	44.0	54	0.535	0.60	3,213
December	49	13.8	34	0.337	0.39	2,091
The year	.....	.....	.....	.....	9.64	52,384

MEAN MONTHLY DISCHARGE of Milk river at Peters' ranch

Area of watershed 101 square miles

Average run-off per square mile 309.1 acre-feet

YEAR	Jan. Sec.-ft.	Feb. Sec.-ft.	Mar. Sec.-ft.	April Sec.-ft.	May Sec.-ft.	June Sec.-ft.	July Sec.-ft.	Aug. Sec.-ft.	Sept. Sec.-ft.	Oct. Sec.-ft.	Nov. Sec.-ft.	Dec. Sec.-ft.	Total Acre-ft.
1909	.....	.....	.....	.....	.....	.....	*173a*	53	48	50	*52b*	.....	*8,305a*
1910	.....	.....	.....	*38b*	34	32	26	21	26	21	27	.....	*13,256a*
1911	.....	.....	.....	*62a*	60	75	36	41	65	38	*43a*	.....	*20,779a*
1912	.....	.....	.....	*51b*	58	31	41	22	25	27	34	*21a*	*16,731a*
1913	13	21	25	78	59	40	24	22	25	31	28	18	23,128
1914	15	14	30	61	26	18	15	15	15	39	31	20	18,051
1915	16	17	65	41	37	120	102	68	78	73	51	40	42,857
1916	31	102	80	80	82	114	72	83	76	61	54	34	52,384
Ave. sec.-ft.	19	38	50	58	51	61	45	41	45	43	39	28	34,105
Ave. ac.-ft.	1,168	2,110	3,074	3,451	3,136	3,630	2,767	2,522	2,678	2,644	2,320	1,722	31,222

a Records incomplete omitted from averages.
b Reduced to a monthly average

SOUTH BRANCH OF MILK RIVER AT CROFF'S RANCH

Location.—On the SW. ¼ Sec. 29, Tp. 37N, Rge. 9, West Principal Meridian, Montana, U.S.A.

Records available.—April 13, 1913, to December 31, 1916.

Gauge.—Stevens continuous water stage recorder; elevation of zero maintained at 87.08 feet since establishment.

Bench-mark.—Iron pipe; assumed elevation 100.00 feet.

Channel.—Permanent except in high water.

Discharge measurements.—During high stages from cable; during ordinary stages by wading.

Remarks.—This station is maintained in conjunction with the United States Geological Survey.

DISCHARGE MEASUREMENTS of South branch of Milk river at Croff's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 11	W. A. Lamb (U.S.G.S.)	80.0	324.0	4.41	6.25	1,430
Mar. 17	S. H. Frame	75.0	131.0	1.74	3.86	229
April 7	do	75.0	108.0	1.45	3.47	157
April 26	do	75.0	112.0	1.34	3.41	150
April 26	W. A. Lamb (U.S.G.S.)	76.0	90.0	1.73	3.45	156
May 24	A. H. Tuttle and W. A. Lamb (U.S.G.S.)	73.0	113.0	1.99	3.70	225
June 1	S. H. Frame	77.0	155.0	2.55	4.25	395
June 11	A. H. Tuttle (U.S.G.S.)	76.0	161.0	2.54	4.45	411
June 21	S. H. Frame	77.0	166.0	2.61	4.38	433
June 27	do	78.0	173.0	2.71	4.35	468
July 19	W. A. Lamb (U.S.G.S.)	78.0	78.0	1.87	3.35	146
July 24	W. A. Burton	70.0	82.0	1.16	3.15	95
Aug. 22	W. A. Lamb (U.S.G.S.)	44.5	49.0	1.57	3.01	77
Sept. 6	S. H. Frame	75.0	82.0	1.37	3.22	113
Sept. 19	W. A. Lamb (U.S.G.S.)	35.0	35.6	1.46	2.83	52
Sept. 28	S. H. Frame	33.0	26.4	1.99	2.88	53
Nov. 16	do	37.0	31.2	1.70	2.90	53

DAILY GAUGE HEIGHT AND DISCHARGE of South branch of Milk river at Croff's ranch, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.70*x*	28	2.70	28	3.05	75	3.71	220	3.61	194	4.31	419
2	2.65	24	2.70	28	3.05	75	3.84	257	3.87	266	4.52	509
3	2.70	28	2.70	28	3.05	75	3.73	225	3.82	251	4.09	334
4	2.70	28	2.75	34	3.10	83	3.57	184	3.78	239	3.89	266
5	.....	28*e*	2.75	34	3.05	75	3.49	165	3.79	242	3.90	266
6	.....	28*e*	2.70	28	3.05	75	3.41	147	3.78	239	4.14	338
7	.....	28*e*	2.70	28	3.05	75	3.46	158	3.76	234	3.94	266
8	.....	28*e*	2.65	24	3.25	111	3.53	174	3.76	234	3.81	223
9	.....	28*e*	2.70	28	5.30	900	3.64	201	3.66	207	3.75	201
10	.....	28*e*	2.70	28	6.60*x*	1,640	3.69	214	3.64	201	4.08	291
11	2.70	28	2.70	28	6.40*x*	1,520	3.70	217	3.58	186	4.36	381
12	2.70	28	2.75	34	.....*v*	1,300	3.79	242	3.57	184	4.22	334
13	2.70	28	2.75	34	.....*v*	777	3.76	234	3.57	184	3.94	251
14	2.70	28	2.75	34	4.65	568	3.65	204	3.58	186	3.86	231
15	2.70	28	2.80	39	.....*v*	448	3.70	217	3.60	191	3.80	217
16	2.65	24	8.60	2,840	.....*v*	346	3.82	251	3.61	194	3.81	223
17	2.60	19	7.00	1,880	.....*v*	308	3.69	214	3.58	186	3.82	228
18	2.65	24	5.95	1,260	.....*v*	293	3.62	196	3.53	174	3.85	239
19	2.70	28	5.10	792	3.94	281	3.62	196	3.49	165	3.90	257
20	2.70	28	5.90	1,230	4.02	314	3.59	189	3.47	160	4.20	359
21	2.70	28	5.30	900	4.14	355	3.54	177	3.46	158	4.38	431
22	2.70	28	4.15	359	4.02	314	3.54	177	3.45	156	4.62	545
23	2.65	24	4.15	359	3.76	234	3.53	174	3.46	158	4.75	616
24	2.65	24	4.15	359	3.63	199	3.56	181	3.62	196	4.34	439
25	2.65	24	4.10	341	3.60	191	3.53	174	3.85	260	4.10	359
26	2.60	19	3.90	275	3.58	186	3.43	152	.....*v*	322	4.14	381
27	2.65	24	3.15	92	3.66	207	3.51	169	.....*v*	616	4.31	460
28	2.70	28	3.15	92	3.68	212	3.65	204	4.77	626	.....*v*	484
29	2.70	28	3.10	83	3.59	189	3.68	212	.....*v*	484	.....*v*	536
30	2.75	34	.....	.....	3.55	179	3.64	201	4.70	592	4.82	670
31	2.70	28	.....	.....	3.53	174	.....	.....	4.39	451	.....	.....

e Discharge estimated.
x Chain gauge heights January 1 to March 10; automatic gauge heights March 11 to September 19.
v Discharge obtained by hourly method from automatic gauge record.

DAILY GAUGE HEIGHT AND DISCHARGE of South branch of Milk river at Croff's ranch, for 1916.—*Concluded.*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....*v*	467	3.07	85	2.90	59	2.90	59	3.00	74	2.80	45
2	4.09	338	2.99	72	2.90	59	2.90	59	3.00	74	2.80	45
3	4.02	314	2.94	65	.....*v*	95	2.95	66	2.95	66	2.85	52
4	3.99	304	2.91	60	.....*v*	279	3.00	74	3.00	74	2.80	45
5	3.88	269	2.88	56	.....*v*	202	3.10	90	2.95	66	2.85	52
6	3.79	242	2.88	56	3.23	112	3.15	98	3.00	74	2.80	45
7	3.70*x*	217	2.87	55	3.08	87	3.10	90	3.00	74	2.80	45
8	.....*x*	217*e*	2.86	53	3.02	77	3.15	98	2.50	18	2.85	52
9	3.70	217	.....*v*	84	2.98	71	3.15	98	2.55	22	.....	48
10	3.60	191	.....*v*	222	2.97	70	3.10	90	2.55	22	2.80	45
11	3.50	167	3.50	167	2.96	68	3.15	98	.....	37	2.70	34
12	3.55	179	3.28	121	2.95	66	3.15	98	2.85	52	2.70	34
13	3.40	145	3.16	100	2.94	65	3.10	90	2.80	45	2.75	40
14	3.40	145	3.20	107	2.89	58	3.10	90	2.80	45	2.70	34
15	3.40	145	3.16	100	2.92	62	3.05	82	2.85	52	2.75	40
16	3.30	125	3.04	80	2.90	59	3.05	82	2.85	52	2.65	30
17	3.40*x*	145	3.00	74	2.89	58	3.00	74	2.95	66	2.65	30
18	3.40*x*	145	3.18	104	2.86	53	3.00	74	2.90	59	2.70	30
19	3.35	135	3.41	147	2.83*x*	49	3.00	74	3.00	74	2.70	30
20	3.25	116	3.22	111	.....	48*e*	3.05	82	3.00	74	2.75	30
21	3.21	109	3.11	92	.....	47*e*	3.00	74	2.95	66	2.75	29
22	3.17	102	3.02	77	.....	47*e*	3.00	74	2.95	66	2.70	29
23	3.16	100	3.00	74	.....	46*e*	3.00	74	3.00	64	2.75	29
24	3.15	98	2.96	68	2.80*x*	45	2.95	66	3.00	62	2.80	29
25	3.14	97	2.94	65	2.80	49	2.90	59	2.90	59	2.80	29
26	3.14	97	2.93	64	.....	49*e*	2.90	59	2.90	59	2.80	28
27	3.27	120	2.98	71	.....	53*e*	2.95	66	2.80	45	2.85	28
28	3.44	154	2.97	70	2.88	56	3.00	74	2.80	45	2.80	28
29	3.23	112	2.94	65	.....	58	2.95	66	2.80	45	2.75	28
30	3.16	100	2.93	64	2.90	59	2.95	66	2.85	52	2.70	28
31	3.12	93	2.91	60	.....	.....	2.95	66	.....	.....	2.70	28

e Discharge estimated.
x Automatic gauge heights March 11 to July 7; July 18 to September 19; chain gauge heights July 8 to July 17; September 24 to December 31.
v Discharge obtained by hourly method from automatic gauge record.

MONTHLY DISCHARGE of South branch of Milk river at Croff's ranch, for 1916

(Drainage area 288 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	34	19	26.7	0.093	0.11	1,642
February	2,840	24	390.0	1.350	1.46	22,433
March	1,640	75	380.0	1.320	1.52	23,365
April	257	147	198.0	0.688	0.77	11,782
May	626	156	262.0	0.910	1.05	16,110
June	670	201	358.0	1.240	1.38	21,302
July	467	93	174.0	0.604	0.70	10,699
August	222	53	86.7	0.301	0.35	5,331
September	279	45	73.5	0.255	0.28	4,374
October	98	59	77.7	0.270	0.31	4,780
November	74	18	56.1	0.195	0.22	3,340
December	52	28	36.1	0.125	0.14	2,220
The year	.....	.....	.....	.....	8.29	127,378

MEAN MONTHLY DISCHARGE of Milk river at Croff's ranch

Area of watershed 288 square miles

Average run-off per square mile 263.8 acre-feet

YEAR	Jan. Sec.-ft.	Feb. Sec.-ft.	Mar. Sec.-ft.	April Sec.-ft.	May Sec.-ft.	June Sec.-ft.	July Sec.-ft.	Aug. Sec.-ft.	Sept. Sec.-ft.	Oct. Sec.-ft.	Nov. Sec.-ft.	Dec. Sec.-ft.	Total Acre-ft.
1905					51	49	24	8	4	*17a*			*8,850a*
1906			*26a*	40	76	91	13	11	7	14	24		17,400
1907				*67a*	301	378	148	55	94	52	*41a*		67,000
1908				402	267	*d*		71	47	84	103		*58,800a*
1909						334	185	60	38	34	49		*42,300a*
1910	*25b*	*25b*	*65b*	129	114	68	18	11	33	32	28	*25b*	34,600
1911				*253a*	267	207	94	61	128	62			53,700
1912				239	196	77	83	37	34	45	38	*33a*	45,900
1913				479	312	200	79	44	23	52	31	20	63,421
1914			*86a*	220	120	63	17	14	17	64	36	18	37,262
1915	12	15	74	84	125	264	152	63	118	80	56	43	65,730
1916	27	390	380	198	262	358	174	87	74	78	56	36	127,378
Average Sec.-ft.	21	143	173	224	190	189	99	44	51	54	47	28	56,933
Average Acre-ft.	1,291	7,942	10,637	13,328	11,683	11,246	6,087	2,705	3,035	3,320	2,797	1,722	75,792

a Records incomplete, omitted from averages.
b Estimated flow.
d Big flood, no records

SOUTH BRANCH OF MILK RIVER AT MACKIE'S RANCH

Location.—On the NW. ¼ Sec. 31, Tp. 1, Rge. 18, W. 4th Mer.
Records available.—July 14, 1909, to October 31, 1915.
Remarks.—This station was not maintained during 1916.

MEAN MONTHLY DISCHARGE in Second-feet of South branch of Milk river at Mackie's ranch

MONTH	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	Mean in Sec.-ft.	Mean in Acre-ft.
October		30	74	43.01	68.0	70*h*	93	62	3,872
November		38*a*	84*c*	42.00*e*					
December									
January									
February									
March									
April	138.0	258*b*	222*d*	430.00*f*	292.0*g*	73		106	6,270
May	121.0	275	209	332.00	102.0*h*	130		213	13,124
June	71.0	254	79	216.00	60.0	249		155	9,215
July	15.0	90	64	100.00	15.0	139		70	4,331
August	4.4	54	36	51.00	10.3	61		36	2,230
September	31.0	141	33	18.40	11.4	130		61	3,614
Total in acre-ft.	22,922	60,310	42,145	68,924	16,677	51,492			42,656

a 1-27.
b 17-30.
c 1-3.
d 5-30.
e 1-16.
f 6-30.
g 4-10.
h 6, 20-31.

MILK RIVER AT MILK RIVER

Location.—On the NE. ¼ Sec. 21, Tp. 2, Rge. 16, W. 4th Mer.

Records available.—July 1, 1909, to December 31, 1916.

Gauge.—Vertical staff used from establishment of station until February 16, 1916, when a new box-chain gauge was placed on railway bridge. Zero of gauge maintained at elevation of 3,403.39. Gauge read by Dan O'Connell.

Bench-mark.—Permanent iron bench-mark; elevation 3,412.42 feet above mean sea-level. (Geodetic Survey of Canada).

Channel.—The stream flows in one channel at all stages; bed consists of sand and fine gravel.

Discharge measurements.—At low stages by wading; at high stages from traffic bridge 150 feet above the gauge.

Accuracy.—Except during ice conditions and periods of high water, stage-discharge relation permanent. Twelve open water measurements were taken by means of which a rating curve was drawn representing average conditions. Gauge read daily to tenths and hundredths. Daily discharge ascertained by applying mean daily gauge heights to rating table from February 19 to March 29; April 1 to May 9, and July 20 to November 7. Bolster method used February 17 and 18, and between May 10 and July 19. Daily discharge during ice conditions ascertained from hydrograph derived by plotting five discharge measurements, mean daily gauge height and temperatures.

DISCHARGE MEASUREMENTS of Milk river at Milk River, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 4	W. H. Storey	46.5	48.4	0.69	2.30*b*	34.0
Feb. 1	V. A. Newhall	39.0	54.7	0.23	3.10*b*	12.6
Feb. 18	G. H. Whyte	130.7	675.3	4.92	8.06	3,323.0
Feb. 19	do	130.7	542.2	3.59	7.04	1,944.0
Mar. 6	L. J. Gleeson	84.0	72.6	0.69	3.29*b*	50.0
Mar. 22	S. H. Frame	119.8	288.4	2.09	2.96	602.0
April 12	do	119.0	200.0	1.81	2.21	361.0
May 10	do	120.0	191.4	1.60	2.08	306.0
May 30	do	121.0	342.5	2.61	3.14	893.0
June 20	W. A. Burton	119.6	226.3	1.78	2.32	403.0
June 23	J. E. Degnon	120.0	340.7	2.40	3.09	815.0*e*
July 19	W. A. Burton	119.0	181.5	1.68	2.01	306.0
Aug. 10	S. H. Frame	120.0	283.6	2.15	2.91	610.0
Aug. 31	do	118.0	116.2	1.46	1.56	169.0
Oct. 12	do	120.0	157.6	1.32	1.81	219.0
Dec. 5	H. W. Rowley	121.0	101.0	1.03	2.09*b*	115.0
Dec. 26	do	120.0	85.0	0.86	2.46*b*	73.0

b Ice conditions from Jan. 1 to Feb. 16; Mar. 1 to March 9; Nov. 8 to Dec. 31.
e Discharge estimated by surface velocities.

DAILY GAUGE HEIGHT AND DISCHARGE of Milk river at Milk River, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.15*b*	38.0	3.10	12.6	3.41	310	2.14	341	2 14	341	3.08	854
2	2 20	36.0	3.25	12 8	2.90	250	2 34	407	2 15	344	3.08	840
3	2 23	35.0	3.50	13.2	3.25	180	2 54	472	2.49	456	3.12	845
4	2.30	34.0	3.60	13.8	3.08	120	2 24	374	2 19	358	2.68	685
5	2.40	33.0	3.58	14.0	3.57	54	2.09	325	2.19	358	2.53	630
6	2.45	33.0	3.80	14.2	3.29	50	1.99	292	2.24	374	2.88	735
7	2.50	32 0	3.80	15 0	3.25	140	1.97	286	2.14	341	2.81	705
8	2.55	31.0	3.80	17.0	3.19	280	1.99	292	2.06	315	2.44	573
9	2.55	31.0	4.02	20.0	3.39*b*	420	2.19	358	2.16	348	2.38	542
10	2.50	29.0	4.05	24.0	5.09	1,306	2.19	358	2.06	300*s*	2.28	500
11	2.60	24.0	4.27	40.0	6.69	1,829	2.24	374	2.08	325	2.73	634
12	2.75	22.0	3.65	160.0	5.94	1,583	2.21	364	1.98	300	3.13	760
13	2.85	21.0	3.55	290.0	4.84	1,224	2.27	384	1.99	320	2.67	595
14	2.85	20.0	3.40	420.0	3.74	864	2.14	341	2.01	335	2.38	490
15	2.87	20.0	3.35	550.0	3.04	636	2.14	341	2.04	353	2.35	470
16	2.95	20.0	3.70*b*	680.0	2.99	619	2.27	384	2.04	367	2.23	427
17	2.85	21.0	8.50	3,467.0*s*	3.14	668	2.19	358	2.08	420	2.18	395
18	2.90	22.0	8.13	3,346.0*s*	2.69	521	2.06	315	1.99	368	2.20	395
19	3.07	24.0	7.03	1,940.0	2.74	537	2.01	299	1.94	365	2.23	385
20	2.82	25.0	6.73	1,842.0	2.79	554	2.04	309	1.91	372	2.32	403
21	2.81	24.0	5.94	1,583.0	2.94	603	1.99	292	1.84	360	2.63	555
22	2.84	23.0	5.18	1,335.0	2.96	609	1.94	276	1.89	393	2.83	680
23	2.83	22.0	4.78	1,204.0	2.64	505	1.97	286	2.02	443	3 09	815
24	2.85	21.0	4.38	1,074.0	2.39	423	1.94	276	2 27	533	3.16	840
25	3.00	20.0	4.19	1,012.0	2.19	358	1.87	253	2.70	686	2.65	667
26	3.00	19.0	4.22	1,021.0	2.14	341	1.94	276	3.28	890	2.53	618
27	3.13	18.0	3.94	929.0	2.19	358	1.91	266	3.28	905	2.76	688
28	3.20	16.0	3.71	855.0	2.28	387	2.04	309	3.69	1,048	2.96	750
29	3.50	15.0	3.26*b*	370.0	2.19	358	2.24	374	3.44	980	3.46	905
30	3.65	14.0	.....	.....	2.09	325	2.27	384	3.14	893	3.68	967
31	3.35	13.0	.....	.....	1.87	253	.....	.....	3.30	933	.....	.....

b Ice conditions from Jan. 1 to Feb. 16; Feb. 29 to Mar. 9; Nov. 8 to Dec. 31.
s Shifting conditions, Feb. 17 and 18; May 10 to July 19.

DAILY GAUGE HEIGHT AND DISCHARGE of Milk river at Milk River, for 1916—*Concluded*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.39	870	1.58	167	1.45	133	1.58	139	1.70	200	2.03	118
2	2.99	730	1.57	164	1.43	128	1.62*x*	146	1.71	203	2.13	117
3	2.66	620	1.53	154	1.65	185	1.57	164	1.66	188	2.11	116
4	2.55	580	1.48	141	2.35	410	1.60	172	1.70	200	2.13	116
5	2.48	550	1.47	138	3.43	763	1.56	162	1.71	203	2.12	115
6	2.28	475	1.48	141	2.73	534	1.72	206	1.72	206	2.13	114
7	2.18	435	1.48	141	2.13	338	1.96	282	1.65	185	2.10	113
8	2.28	467	1.48	141	1.90	263	1.96	282	1.50*b*	177	2.03	112
9	2.23	445	1.83	240	1.94*x*	300	1.93	273	1.53	171	2.00	110
10	2.18	420	2.91	593	1.82	232	1.85	246	1.95	164	1.96	109
11	2.06	372	2.65	508	1.78	223	1.80	230	1.45	157	2.00	108
12	2.05	367	2.20	361	1.76	200	1.81	233	1.65	152	2.02	106
13	1.98	333	1.96	282	1.73	183	1.85	246	1.75	148	2.05	104
14	1.87	290	1.78	224	1.69	185	1.80	230	1.95	144	2.10	102
15	1.83	275	1.90	263	1.70	187	1.75	215	1.90	142	2.15	100
16	1.78	255	1.76	218	1.73	190	1.76	218	2.05	139	2.10	98
17	1.88	280	1.68	194	1.70	182	1.77	221	2 03	137	2 05	95
18	1.93	292	1.73	209	1.65	173	1.71	203	2 05	134	2.10	92
19	2.01	306*s*	2 01	299	1.63	163	1.69	197	2 35	133	2.10	87
20	1.96	282	2.10	328	1.56	151	1.71	203	2.27	131	2.10	81
21	1.83	240	1.83	240	1.55	141	1.75	215	2.26	129	2.15	78
22	1.66	188	1.78	224	1.53	139	1.80	230	2.30	127	2 10	76
23	1.60	172	1.73	209	1.52	135	1.85	246	2 33	126	2 25	75
24	1.66	188	1.68	194	1.51	132	1.80	230	2 32	124	2 35	74
25	1.68	194	1.63	180	1.50	127	1.75	215	2.27	123	2.45	74
26	1.68	194	1.62	177	1.50	139	1.80	230	2.20	122	2.46	73
27	1.76	218	1.60	172	1.52	146	1.80	230	2.23	121	2 50	73
28	1.86	250	1.63	180	1.56	148	1.75	215	2.22	120	2 50	73
29	2.00	295	1.63	180	1.62	152	1.73	209	2.16	119	2 54	73
30	1.78	224	1.59	169	1.60	146	1.73	209	2.10	118	2 50	73
31	1.64	182	1.56	162	.....	.....	1.73	209	.....	.....	2.50*b*	72

b Ice conditions from Jan. 1 to Feb. 16; Feb. 29 to Mar. 9; Nov. 8 to Dec. 31.
s Shifting conditions, Feb. 17 to Feb. 18; May 10 to July 19.
x Sept. 9 to Oct. 2, mean daily gauge heights from automatic record; discharges from hydrograph "Seepage Investigations on Milk river."

MONTHLY DISCHARGE of Milk river at Milk River, for 1916

(Drainage area 1,104 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	38	13.0	24	0.022	0.03	1,476
February	3,467	12.6	768	0.696	0.75	44,176
March	1,829	50.0	538	0.487	0.56	33,080
April	472	253.0	332	0.301	0.34	19,755
May	1,048	300.0	488	0.442	0.51	30,006
June	967	385.0	645	0.584	0.65	38,380
July	870	172.0	354	0.321	0.37	21,767
August	593	138.0	226	0.205	0.24	13,896
September	763	127.0	218	0.197	0.22	12,972
October	282	139.0	216	0.196	0.23	13,281
November	206	118.0	151	0.137	0.15	8,985
December	118	72.0	94	0.085	0.10	5,780
The year	.....	.....	.....	.....	4.15	243,554

Mean Monthly Discharge of Milk river at Milk River

Area of watershed 1,104 square miles

Average run-off per square mile 111.5 acre-feet

Year	Jan. Sec.-ft.	Feb. Sec.-ft.	Mar. Sec.-ft.	April Sec.-ft.	May Sec.-ft.	June Sec.-ft.	July Sec.-ft.	Aug. Sec.-ft.	Sept. Sec.-ft.	Oct. Sec.-ft.	Nov. Sec.-ft.	Dec. Sec.-ft.	Total Acre-ft.
1909	.....	.....	.....	.....	.....	.....	299	129	78	72	*120a*	.....	*13,449a*
1910	.....	.....	.....	204	174	99	30	21	55	54	.....	.....	*38,477a*
1911	.....	.....	.....	308	399	355	128	91	252	119	126	79	112,130
1912	38	77	242	565	293	105	126	62	65	81	90*b*	13*b*	106,007
1913	7	8	7	745	415	256	118	73	41	87	60	45	112,333
1914	25	10	92	317	150	71	25	22	28	133	80	28	59,241
1915	26	27	253	174	180	432	263	151	225	192	122	63	127,567
1916	24	768	538	332	488	645	354	226	218	216	151	94	243,554
Average sec.-ft.	24	178	226	377	300	280	168	97	120	119	105	54	126,806
Average acre-ft.	1,476	9,886	13,896	22,433	18,446	16,661	10,330	5,964	7,140	7,317	6,248	3,320	123,117

a Records incomplete omitted from averages.
b Discharge estimated.

MILK RIVER AT WRITING-ON-STONE POLICE DETACHMENT

Location.—On SW. ¼ Sec. 35, Tp. 1, Rge. 13, W. 4th Mer.
Records available.—August 2, 1909, to October 31, 1915.
Remarks.—This station was not maintained during 1916.

Mean Monthly Discharge of Milk river at Writing-on-Stone

Area of watershed 1,546 square miles

Average run-off per square mile 53.9 acre-feet

Year	Mar. Sec.-ft.	April Sec.-ft.	May Sec.-ft.	June Sec.-ft.	July Sec.-ft.	Aug. Sec.-ft.	Sept. Sec.-ft.	Oct. Sec.-ft.	Nov. Sec.-ft.	Total Acre-ft.
1909	.....	.....	.....	.....	.....	145	81	78	108	*14,656a*
1910	.....	207	184	108	33	18	53	49	*50a*	40,556
1911	*479a*	317	371	334	161	96	244	134	*166a*	110,636
1912	.....	.....	*226a*	*93a*	*130a*	68	64	78	79	*34,626a*
1913	.....	751	415	279	139	72	48	81	64	111,438
1914	*163a*	296	160	85	30	17	26	117	.....	48,695
1915	*542a*	213	204	467	275	162	227	173	.....	117,994
Average Sec.-ft.	.....	357	267	255	128	83	106	101	84	85,864
Average Acre-ft.	.....	21,243	16,417	15,174	7,870	5,103	6,307	6,210	4,998	83,322

a Records incomplete; not included in average.

DEER CREEK AT DICKINSON'S RANCH

Location.—On the SW. ¼ Sec. 15, Tp. 1, Rge. 12, W. 4th Mer.
Records available.—May 26, 1911, to November 7, 1911; May 3, 1915, to October 31, 1915. Discharge measurements only in 1912-14.
Gauge.—Vertical staff; zero elevation maintained at 90.72 feet since establishment.
Bench-mark.—Permanent iron bench-mark, assumed elevation 100.00 feet.
Channel.—One channel at all stages.
Discharge measurements.—At low stages made by wading; at high stages could be made from traffic bridge two hundred feet above gauge.
Remarks.—This station was not maintained during 1916.

DISCHARGE MEASUREMENTS of Deer creek at Dickinson's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
March 10	L. J. Gleeson	10.5	3.05	2.58	2.41	7.9

DEER CREEK CATTLE COMPANY EAST DITCH FROM DEER CREEK

Location.—On the SW. ¼ Sec. 36, Tp. 1, Rge. 12, W. 4th Mer.
Records available.—April 1, 1912, to November 23, 1912; March 31, 1915, to September 11, 1915. Discharge measurements only during 1914, and March 31 to June 7, 1915.
Gauge.—Vertical staff; elevation of zero maintained at 93.49 feet since establishment.
Bench-mark.—Permanent iron bench-mark located 250 feet below headgates; assumed elevaton 100.00 feet.
Discharge measurements.—Made with current-meter by wading or with a weir.
Observer.—F. W. Webster.
Remarks.—The Deer Creek Cattle Company diverts all the water from Deer creek through their two ditches, except in flood stages. No records were obtained during 1915, but it is understood that water was diverted and used for irrigation purposes during April.

DEER CREEK CATTLE COMPANY WEST DITCH FROM DEER CREEK

Location.—On the SW. ¼ Sec. 36, Tp. 1, Rge. 12, W. 4th Mer.
Records available.—May 17 to July 27, 1915. Discharge measurements during 1914 and parts of May and July, 1915.
Gauge.—Vertical staff; zero maintained at elevation of 100.50 feet since establishment.
Bench-mark.—Permanent iron bench-mark at East Ditch station; assumed elevation 100.00 feet.
Discharge measurements.—Made with current-meter by wading or with a weir.
Observer.—F. W. Webster.
Remarks.—No records were obtained during 1916, and it is understood that very little, if any, water was diverted through this ditch during 1916.

FORNFEIST DITCH NEAR ST. KILDA

Location.—On the SW. ¼ Sec. 31, Tp. 1, Rge. 11, W. 4th Mer.
Records available.—From September 16, 1915, to October 31, 1915.
Gauge.—Vertical staff; zero maintained at elevation of 98.45 feet since establishment.
Bench-mark.—Temporary wooden bench-mark; assumed elevation 100.00 feet.
Discharge measurements.—Made with current-meter by wading or by weir.
Observer.—Julius Fornfeist.
Note.—Water was diverted during 1916, but no records have been obtained.

MILK RIVER AT PENDANT D'OREILLE POLICE DETACHMENT

Location.—On the SW. ¼ Sec. 21, Tp. 2, Rge. 8, W. 4th Mer.
Records available.—August 5, 1909, to October 31, 1915.
Gauge.—Vertical staff; zero maintained at elevation of 82.45 feet since establishment.
Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.
Channel.—Composed of sand and shifts in change of stage.
Discharge measurements.—Made from a cable and car during high water; at low stages by wading.
Remarks.—Two discharge measurements only in 1916.

DISCHARGE MEASUREMENTS of Milk river at Pendant D'Oreille police detachment, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 12	L. J. Gleeson	184	650	5.83	6.53	3,782
April 2	do	107	194	1.21	3.05	355

MEAN MONTHLY DISCHARGE of Milk river at Pendant D'Oreille

Area of watershed 2,169 square miles

Average run-off per square mile 41.9 acre-feet

YEAR	Mar. Sec.-ft.	April Sec.-ft.	May Sec.-ft.	June Sec.-ft.	July Sec.-ft.	Aug. Sec.-ft.	Sept. Sec.-ft.	Oct. Sec.-ft.	Nov. Sec.-ft.	Total Acre-ft.
1909	.....	.....	.....	.....	.....	121*b*	76	85	110	*14,656a*
1910	.....	189	186	90	29	11	22	47	*44a*	35,371
1911	.....	366	419	382	228	111	417	176	*135a*	128,898
1912	.....	*325a*	326	127	136	72	64	82	*96a*	54,220
1913	.....	894*b*	493	306	146	95	32	71	.....	113,955
1914	*171a*	358	145	81	26	11	23	155	.....	53,979
1915	*578a*	260	226	580	320	187	211	179	.....	136,703
Average Sec.-ft.	.....	413	299	261	147	87	121	114	73*b*	87,188
Average Acre-ft.	.....	240,575	18,385	15,531	9,039	5,349	7,200	7,010	4,344	91,400

a Records not complete, omitted from average.
b Reduced to monthly average.

MILK RIVER AT SPENCER'S LOWER RANCH

Location.—South of SE. ¼ Sec. 3, Tp. 1, Rge. 5, W. 4th Mer.

Records available.—August 7, 1909, to December 25, 1915.

Gauge.—Gurley automatic water stage register installed in a wooden shelter, three hundred feet south of the international boundary, with a staff gauge inside the stilling box and another outside at the mouth of the intake pipe. Gauges are maintained at an elevation of 2,696.58 feet. Staff gauge read once daily by Frank Galloway.

Bench-marks.—Permanent iron bench-mark; elevation 2713.64 feet (U.S.G.S. Havre datum) located on the left bank, 1,300 feet up stream from the boundary line.

Channel.—Composed of gravel, rock and quicksand and is subject to shifting conditions.

Discharge measurements.—Made by wading at low stages and by a cable car structure at high stages.

Winter flow.—From December to April the stream is frozen over and no records of value are obtained.

Co-operation.—This station is maintained in conjunction with United States Geological Survey.

Accuracy.—Stage-discharge relation permanent except during periods of high water and ice; numerous discharge measurements are therefore necessary to define rating curves and periods of shifting control.

Discharge applied as follows:—January 1 to March 13, estimated, based on discharge measurements, temperatures and discharge at Milk river; March 14 to 28, based on gauge heights and discharge measurements at cable; March 29 to 31, based on measurement March 31; April 1 to 12, Bolster method for shifting control; April 13 to May 5, well defined curve between 300 second-feet and 400 second-feet; May 6 to 17, Bolster method for shifting control; May 18 to 24, based on measurement May 17; May 25 to June 12, based on measurement June 12; June 12 to 13, Bolster method for shifting control; June 14, to September 6, well defined curve between 160 second-feet and 840 second-feet; September 7 to 13, Bolster method for shifting control; September 14 to November 2, Bolster method for shifting control; discharge estimated from November 5 to December 31.

Mean daily gauge heights found by averaging gauge heights registered by Gurley weight driven water stage register. Daily discharge ascertained by applying daily gauge heights to rating table except for periods during which stage-discharge relation is affected by shifting control or ice. Results obtained by use of rating tables good; other results, fair.

DISCHARGE MEASUREMENTS of Milk river at Spencer's lower ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 14	L. J. Gleeson	136.0	446.8	4.60	6.64	2,064
Mar. 15	W. A. Lamb (U.S.G.S.)	100.0	300.0	3.97	5.51	1,190
Mar. 23	L. J. Gleeson	99.5	224.2	3.49	4.20	766
Mar. 31	do	90.0	188.0	2.25	3.69	413
April 12	do	102.0	183.6	2.13	3.68	392
April 30	W. A. Lamb (U.S.G.S.)	67.0	111.0	2.08	3.36	231
May 5	H. W. Rowley	116.0	156.0	1.90	3.50	297
May 12	A. H. Tuttle (U.S.G.S.)	66.0	111.0	2.59	3.54*x*	287
May 17	H. W. Rowley	115.0	145.0	1.71	3.50	248
June 12	do	120.0	220.0	3.29	4.37	722
June 14	A. H. Tuttle (U.S.G.S.)	123.0	250.0	3.76	4.81	939
July 7	H. W. Rowley	120.0	260.0	2.64	4.41	686
July 28	do	121.0	143.0	1.59	3.49	228
Aug. 17	do	48.0	127.0	1.98	3.54	251
Sept. 7	W. A. Lamb (U.S.G.S.)	125.0	240.0	4.05	4.67	971
Sept. 13	H. W. Rowley	118.0	152.0	1.68	3.39	255
Oct. 2	H. W. Rowley and V. A. Newhall	41.0	64.7	2.22	3.34	143
Nov. 2	H. W. Rowley	44.0	73.1	2.34	3.35	171

x Outside staff gauge.

DAILY GAUGE HEIGHT AND DISCHARGE of Milk river at Spencer's lower ranch, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	2.80	.....	.....	700*e*	3.56	344	3.48	289	5.01	1,130
2	3.95*x*	.....	2.95	.....	.....	700*e*	3.50	314	3.61	354	4.91	1,060
3	3.95	.....	3.08	.....	.....	700*e*	3.42	274	3.65	375	4.68	915
4	4.00	.....	3.50	.....	.....	700*e*	3.58	354	3.54	319	4.73	946
5	4.00	.....	3.70	.....	.....	700*e*	3.78	454	3.58	339	4.82	1,000
6	3.95	.....	3.68	.....	.....	700*e*	3.87	503	3.81	446	4.61	871
7	3.96	.....	3.70	.....	.....	700*e*	.....	484*e*	3.64	355	4.47	784
8	3.96	.....	3.70	.....	.....	700*e*	.....	465*e*	3.63	346	4.34	706
9	3.98	.....	3.75	.....	.....	700*e*	.....	447*e*	3.64	346	4.63	883
10	4.00	.....	3.75	.....	.....	700*e*	.....	428*e*	3.62	331	4.50	803
11	3.90	.....	3.78	.....	.....	700*e*	.....	410*e*	3.60	317	4.70	927
12	3.89	.....	3.78	.....	.....	700*e*	3.68	391	3.58	303	4.41	748
13	3.90	.....	.....	.....	.....	700*e*	.....	391*e*	3.50	267	4.35	688
14	3.88	.....	3.80	.....	6.64*x*	2,060	.....	391*e*	3.49	258	4.73	896
15	3.85	.....	8.45	.....	4.61	1,190	.....	391*e*	3.45	237	4.43	712
16	3.80	.....	7.50	.....	4.16	984	.....	391*e*	3.48	245	4.22	589
17	3.70	.....	7.20	.....	3.81	826	3.68	391	3.49	245	4.16	555
18	3.70	.....	6.95	.....	3.90	866	3.71	406	3.49	245	4.08	510
19	3.65	.....	.....	.....	.....	825*e*	3.72	412	3.49	245	4.12	532
20	3.64	.....	.....	.....	.....	784*e*	3.71	406	3.55	271	3.92	425
21	.....	.....	3.50	.....	3.64	744	3.76	433	3.47	237	3.90	415
22	3.60	.....	3.65*x*	.....	3.79	816	3.67	385	3.39	204	4.39	688
23	.....	.....	.....	.....	3.64	766	3.58	339	3.39	204	4.41	700
24	.....	.....	.....	.....	3.57	706	3.65	375	3.39	204	4.58	803
25	3.00	.....	.....	.....	3.38	602	3.64	370	4.22	635	4.68	865
26	2.80	.....	.....	.....	3.23	520	3.65	375	4.58	852	4.70	877
27	2.70	.....	.....	.....	3.02	408	3.58	339	4.73	946	4.50	754
28	2.55	.....	.....	.....	2.92	356	3.52	309	4.68	915	4.31	641
29	2.45	.....	.....	.....	3.46*x*	296	3.48	289	4.90	1,060	4.36	670
30	2.50	.....	.....	.....	3.64	396	3.39	245	5.04	1,160	4.73	896
31	2.75	.....	.....	.....	3.63	384	.....	.....	4.92	1,070	.....	.....

e Discharge estimated.
x Gauge heights January 2 to February 23, from staff at automatic gauge.
Gauge heights March 14 to March 28, from staff at cable.
Gauge heights March 29 to October 31 from automatic gauge.

DAILY GAUGE HEIGHT AND DISCHARGE of Milk river at Spencer's lower ranch, for 1916—*Concluded*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	5.04	1,100	3.57	258	3.31	155	3.26	120	.....	172	4.25	110*e*
2	5.39	1,370	3.42	196	3.31	155	3.34	144	.....	171	4.25	110*e*
3	.....	3,500*e*	3.35	170	3.30	151	3.39	162	.....	182	4.20	110*e*
4	.....	2,000*e*	3.33	162	3.53	341	3.50	204	.....	193	4.20	110*e*
5	.....	1,200*e*	3.32	158	3.71	322	3.58	237	3.44	204	4.15	110*e*
6	.....	800*e*	3.29	148	3.79	360	3.63	262	3.45	180*e*	4.15	100*e*
7	4.39	688	3.32	158	4.67	973	3.59	245	3.45	180*e*	4.00	100*e*
8	4.28	623	3.90	415	4.25	709	3.47	196	3.45	180*e*	3.90	100*e*
9	5.53	1,480	3.56	254	3.94	530	3.43	181	3.46	180*e*	3.50	100*e*
10	4.90	1,000	3.57	258	3.72	412	3.56	232	3.84	180*e*	3.35	100*e*
11	4.42	706	3.89	410	3.59	344	3.67	285	3.85	120*e*	3.40	80*e*
12	4.23	594	4.16	553	3.45	274	3.65	276	3.65	120*e*	3.30	80*e*
13	4.07	505	4.11	527	3.38	240	3.58	245	3.40	120*e*	3.20	80*e*
14	3.90	415	3.85	390	3.36	232	3.52	220	3.30	120*e*	3.55	80*e*
15	3.74	336	3.67	303	3.37	232	3.48	204	.....	120*e*	3.75	80*e*
16	4.02	478	3.57	258	3.38	232	3.49	212	3.08	110*e*	3.85	60*e*
17	3.99	462	3.54	245	3.35	216	3.49	212	.....	110*e*	3.85	60*e*
18	3.69	312	3.70	317	3.41	237	3.47	204	3.27	110*e*	3.80	60*e*
19	3.70	317	3.64	289	3.37	216	3.43	188	3.30	110*e*	3.85	60*e*
20	3.69	312	3.57	258	3.32	188	3.43	188	3.45	110*e*	.....	60*e*
21	3.64	289	3.53	241	3.27	166	3.45	200	3.65	110*e*	3.85	50*e*
22	3.65	294	3.61	276	3.27	162	3.48	212	3.70	110*e*	3.85	50*e*
23	3.60	271	3.72	327	3.25	151	3.56	245	3.70	110*e*	3.85	50*e*
24	3.48	224	3.69	312	3.24	144	3.58	254	3.70	110*e*	3.87	50*e*
25	3.45	208	3.53	241	3.23	137	3.52	228	3.75	110*e*	.....	50*e*
26	3.47	216	3.42	196	3.21	124	3.51	228	.....	110*e*	3.87	40*e*
27	3.48	220	3.38	181	3.24	131	3.48	216	3.80	110*e*	3.85	40*e*
28	3.53	241	3.34	166	3.24	127	3.47	212	3.90	110*e*	3.85	40*e*
29	3.53	241	3.32	158	3.23	120	3.43	196	4.00	110*e*	.....	40*e*
30	3.62	280	3.31	155	3.27	131	3.42	192	4.30	110*e*	3.80	40*e*
31	3.76	346	3.30	151	.....	.....	3.37	173	.....	.....	3.85	40*e*

e Discharge estimated.
x Gauge heights March 29 to October 31 from automatic gauge.

MONTHLY DISCHARGE of Milk river at Spencer's lower ranch, for 1916

(Drainage area 2,514 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	.....	.....	18	0.007	0.01	1,107
February	.....	.....	1,130	0.449	0.48	65,000
March	.....	.....	730	0.290	0.33	44,886
April	503	245	384	0.153	0.17	22,850
May	1,160	204	439	0.175	0.20	26,993
June	1,130	415	766	0.305	0.34	45,580
July	3,500	208	678	0.270	0.31	41,689
August	553	148	262	0.104	0.12	16,110
September	973	120	264	0.105	0.12	15,709
October	285	120	212	0.084	0.10	13,035
November	.....	.....	136	0.054	0.06	8,093
December	.....	.....	72	0.029	0.03	4,427
The year	.....	.....	.....	.....	2.27	305,479

Discharge for the months January, February, March, November and December, estimated by comparison with discharge of Milk river at Milk River and Havre.

MEAN MONTHLY DISCHARGE of Milk river at Spencer's lower ranch

Area of watershed *2,404 and* 2,515 square miles
Average run-off per square mile 60 acre-feet

YEAR	Jan. Sec.-ft.	Feb. Sec.-ft.	Mar. Sec.-ft.	April Sec.-ft.	May Sec.-ft.	June Sec.-ft.	July Sec.-ft.	Aug. Sec.-ft.	Sept. Sec.-ft.	Oct. Sec.-ft.	Nov. Sec.-ft.	Dec. Sec.-ft.	Total Acre-ft.
1909								131*b*	74	73	*85a*		*14,856a*
1910				*219a*	185	108	27	5	44	42			32,310
1911			433*b*	285	363	348	230	116	422	200	*168a*		134,753
1912				580*b*	318	136	113	60	60	78	*77a*		77,869
1913			*340a*	944	530	320	180	85	32	66	81	37	137,037
1914			121*b*	501	158	103	26	7	23	168	65	20	71,917
1915			297*b*	300	224	550	321	204	196	193	115	42	147,796
1916	18*d*	1,130*c*	730*d*	384	439	766	678	262	264	212	136*d*	72*d*	305,479
Average Sec.-ft.	18*d*	226*c*	395	499	317	333	225	109	139	129	99	42	129,595
Average Acre-ft.	1,107	12,551	24,288	29,693	19,492	19,815	13,835	6,702	8,271	7,932	5,891	2,582	152,159

a Records incomplete; not included in average.
b Reduced to monthly averages.
c Estimated and averaged for 5 years as abnormal conditions.
d Estimated.

PAKOWKI LAKE DRAINAGE BASIN

General Description

Pakowki lake received most of the drainage of the Western slope of the Cypress hills, and a small amount of water from the northern slope of the Milk River ridge. It also received, via Etzikom coulee, a certain amount of tail-water from the Alberta Railway Irrigation Company's canals. There is no outlet to this lake, the water level being about 30 feet lower than that of Milk river in Range 8, West of the 4th Meridian.

The streams within this drainage basin are very similar in their general characteristics, all having narrow, deep, and well defined valleys, with a growth of willows along the bottoms. Most of these creeks on the east side of the lake have considerable flats and meadows, covered with native grasses and sage brush, and are to a great extent irrigated from these creeks. During heavy rainfall these creeks are subject to rapid rises and correspondingly rapid falls of stage. Canal creek and the south branch of Manyberries creek drain a considerable part of broken land, devoid of tilth, and the run-off from these creeks, contributed by deep coulees where the subsoil is exposed, is comparatively large, almost all the precipitation finding its way into the creek channels.

There are several irrigation works situated on Manyberries, Ketchum and Canal creeks, all the water coming down from the higher ground, except during a very large run-off, being used in irrigating the lower flats, very little water being discharged into Pakowki lake.

The yield of cultivated hays of different kinds, native hay and alfalfa, has been considerably increased by the use of these waters.

ETZIKOM COULEE NEAR STIRLING

Location.—On SW. $\frac{1}{4}$ Sec. 3, Tp. 7, Rge. 19, W. 4th Mer., at highway bridge, one and one-half miles northeast of Stirling.

Records available.—May 1, 1914, to October 31, 1916.

Drainage area.—The flow in this coulee is partly from its drainage area, but largely from overflow of the Alberta Railway and Irrigation Company's irrigation ditch.

Gauge.—Vertical staff fastened to bridge pile on downstream side against north abutment; zero maintained at elevation 92.83 feet since establishment.

Bench-mark.—Permanent iron bench-mark, located 25 feet east of south end of bridge; assumed elevation 100.00 feet.

Channel.—Composed of clay and liable to be affected by the growth of weeds in bed.

Discharge measurements.—At ordinary stages measurements are made with current-meter by wading. At low water stage with a weir, and at extreme high water with current-meter from the traffic bridge.

Observer.—Wm. Christensen.

DISCHARGE MEASUREMENTS of Etzikom coulee near Stirling, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 22	S. H. Frame	16.5	26.00	1.90	3.27	50.0
April 12	do	10.5	10.00	0.64	1.91	6.4
May 10	do	10.5	9.90	0.80	1.92	7.9
May 29	do	20.0	33.00	1.79	3.48	59.0
May 29	do	83.0	15.20	1.36	.....	206.0*x*
July 20	do	12.0	18.00	0.94	2.68	17.0
Aug. 10	do	15.0	27.40	1.43	3.15	39.0
Aug. 31	do	11.0	10.80	0.71	2.05	7.7
Sept. 21	do	12.5	20.10	1.12	2.72	23.0
Oct. 12	do	11.5	18.80	1.23	2.61	23.0

x Slope measurement.

DAILY GAUGE HEIGHT AND DISCHARGE of Etzikom coulee near Stirling, for 1916

Day	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	2.21	10.80	1.26	1.95	2.45	15.0
2	.....	.....	2.19	10.50	1.25	1.90	4.20	111.0
3	.....	.....	2.22	11.00	1.25	1.90	3.30	49.0
4	.....	.....	2.22	11.00	1.26	1.95	2.95	30.0
5	.....	.....	2.21	10.80	2.07	8.90	2.80	24.0
6	.....	.....	2.21	10.80	2.09	9.10	2.64	19.3
7	.....	.....	2.20	10.60	2.07	8.90	3.30	49.0
8	.....	.....	2.19	10.50	2.09	9.10	2.70	21.0
9	.....	.....	2.17	10.20	2.09	9.10	2.90	28.0
10	.....	.....	2.14	9.80	1.90	6.80	3.09	37.0
11	.....	.....	2.10	9.20	1.95	7.40	3.10	38.0
12	4.83	156.0	2.00	8.00	1.85	6.40	3.12	39.0
13	4.83	156.0	2.00	8.00	1.80	5.80	3.16	41.0
14	3.84	86.0	1.30	2.20	1.75	5.40	2.60	18.3
15	3.15	40.0	1.18	1.55	1.70	5.00	2.35	13.0
16	3.75	80.0	1.17	1.50	1.70	5.00	2.34	12.9
17	3.44	58.0	1.16	1.45	1.70	5.00	2.24	11.2
18	3.20	43.0	1.16	1.45	1.70	5.00	2.19	10.5
19	3.15	40.0	1.14	1.36	1.68	4.80	2.14	9.8
20	3.09	37.0	1.16	1.45	1.66	4.70	2.14	9.8
21	3.18	42.0	1.18	1.55	1.66	4.70	2.15	10.0
22	3.09	37.0	1.20	1.65	1.75	5.40	2.17	10.2
23	3.06	36.0	1.21	1.70	2.65	19.60	2.18	10.4
24	3.05	35.0	1.22	1.75	1.85	6.40	2 20	10.6
25	3.04	34.0	1.22	1.75	2.00	8.00	2.20	10.6
26	3.25	46.0	1.25	1.90	2.70	21.00	2.50	16.0
27	3.21	44.0	1.26	1.95	3.45	59.00	2.55	17.1
28	3.15	40.0	1.26	1.95	3.65	73.00	3.00	32.0
29	3.18	42.0	1.26	1.95	3.45	59.00	3.25	46.0
30	2.65	19.6	1.26	1.95	3.05	35.00	3.45	59.0
31	2.23	11.1	.....	.....	2.50	16.00	.....	.....

DAILY GAUGE HEIGHT AND DISCHARGE of Etzikom coulee near Stirling, for 1916—*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.00	97.0	2.45	15.0	1.85	6.4	2.45	15.0
2	3.80	83.0	2.40	14.0	1.84	6.2	2.48	15.6
3	3.55	66.0	2.32	12.5	3.20	43.0	2.52	16.4
4	3.25	46.0	2.20	10.6	4.15	108.0	2.54	16.9
5	3.14	40.0	2.15	10.0	5.12	176.0	2.54	16.9
6	3.00	32.0	2.06	8.7	5.60	209.0	2.54	16.9
7	2.90	28.0	1.92	7.1	4.90	160.0	2.55	17.1
8	2.73	22.0	1.85	6.4	4.20	111.0	2.59	18.1
9	2.70	21.0	2.95	30.0	3.85	87.0	2.65	19.6
10	2.70	21.0	3.05	35.0	3.60	69.0	2.70	21.0
11	2.70	21.0	3.10	38.0	3.52	64.0	2.70	21.0
12	2.75	22.0	3.10	38.0	3.40	56.0	2.61	18.6
13	2.70	21.0	3.05	35.0	3.30	49.0	2.65	19.6
14	2.55	17.1	3.00	32.0	3.25	46.0	2.65	19.6
15	2.51	16.2	2.94	30.0	3.05	35.0	2.64	19.3
16	2.54	16.9	2.88	27.0	3.05	35.0	2.64	19.3
17	2.55	17.1	2.80	24.0	3.03	34.0	2.60	18.3
18	3.05	35.0	2.76	23.0	3.00	32.0	2.55	17.1
19	2.90	28.0	2.60	18.3	3.00	32.0	2.52	16.4
20	2.68	20.0	2.45	15.0	2.95	30.0	2.49	15.8
21	2.60	18.3	2.39	13.8	2.72	22.0	2.46	15.2
22	2.61	18.6	2.35	13.0	2.75	22.0	2.45	15.0
23	2.60	18.3	2.29	12.0	2.78	24.0	2.46	15.2
24	2.58	17.8	2.25	11.4	2.64	19.3	2.45	15.0
25	2.58	17.8	2.21	10.8	2.58	17.8	2.45	15.0
26	2.54	16.9	2.18	10.4	2.50	16.0	2.42	14.4
27	2.54	16.9	2.16	10.1	2.49	15.8	2.40	14.0
28	2.52	16.4	2.15	10.0	2.46	15.2	2.40	14.0
29	2.54	16.9	2.07	8.9	2.45	15.0	2.39	13.8
30	2.52	16.4	1.98	7.8	2.42	14.4	2.37	13.4
31	2.48	15.6	1.87	6.6			2.35	13.0

MONTHLY DISCHARGE of Etzikom coulee near Stirling, for 1916

(Drainage area 203 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (12-31)	156.0	11.10	54.0	0.266	0.20	2,142
April	11.0	1.36	5.3	0.026	0.03	315
May	73.0	1.90	13.6	0.067	0.08	836
June	111.0	9.80	27.0	0.133	0.15	1,607
July	97.0	15.60	28.0	0.138	0.16	1,722
August	38.0	6.40	17.6	0.086	0.10	1,082
September	209.0	6.20	52.0	0.256	0.28	3,094
October	21.0	13.00	16.7	0.082	0.10	1,027
The period					1.10	11,825

ETZIKOM COULEE NEAR GODDARD

Location.—On SW. ¼ Sec. 2, Tp. 5, Rge. 13, W. 4th Mer., near outlet of Crow Indian lake.
Records available.—May 28, 1915, to October 31, 1915.
Gauge.—Vertical staff maintained at zero elevation of 96.31 feet since establishment.
Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.
Channel.—Gravel and sand, not liable to change.
Discharge measurements.—Made by wading.
Observer.—Wm. Rutherford.
Remarks.—Vegetation growing in channel, and winds likely to affect the records.

DISCHARGE MEASUREMENTS of Etzikom coulee near Goddard, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 21	S. H. Frame	83.0	63.00	1.88	2.26	118.0
April 11	do	18.0	16.00	1.37	1.34	22.0
May 9	do	14.5	12.20	0.61	0.82	7.5
July 18	do	27.0	19.60	0.80	1.42	15.7
Aug. 8	do	14.0	9.30	0.62	0.92	5.8
Aug. 29	do	27.0	17.80	0.90	1.33	16.0
Sept. 19	do	75.0	50.20	1.19	1.99	60.0
Oct. 10	do	15.0	18.30	1.73	1.52	32.0

DAILY GAUGE HEIGHT AND DISCHARGE of Etzikom coulee near Goddard, for 1916

Day	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1				36.0*e*		5.70*e*		7.6*e*
2			1.52	32.0	0.65	5.00		9.0*e*
3				28.0*e*	1.10	13.60	1.06	10.3
4			1.38	24.0	0.90	8.80	1.06	10.3
5				32.0*e*		5.90*e*	1.26	16.2
6			1.63	40.0	0.45	3.00	1.26	16.2
7				40.0*e*	0.85	7.90	1.26	16.2
8				40.0*e*	0.50	3.40		18.5*e*
9			1.63	40.0		3.20		21.0*e*
10				31.0*e*	0.45	2.90*s*	1.46	23.0
11			1.35	22.0		2.60*e*	1.66	35.0
12			1.35	22.0	0.36	2.20		27.0*e*
13	2.26	118		21.0*e*		1.99*e*	1.36	19.0
14	2.26	118		19.6*e*	0.30	1.78	1.31	17.2
15		114*e*	1.25	18.4	0.39	2.30	1.31	17.2
16	2.21	110	1.15	15.1	0.30	1.72		16.2*e*
17		110*e*	1.10	13.6	0.25	1.42		15.2*e*
18		110*e*		12.9*e*		1.50*e*	1.26	14.2
19	2.21	110	1.05	12.2		1.58*e*	1.21	12.8
20		100*e*	1.15	15.1	0.30	1.66	1.06	9.0
21		90*e*		12.8*e*	0.30	1.66		12.5*e*
22	2.01	81	0.98	10.5		1.54*e*	1.31	16.0
23		77*e*	0.90	8.8		1.42*e*	1.31	16.0
24		72*e*	0.75	6.4	0.25	1.30		14.8*e*
25	1.91	68		6.0*e*	0.50	3.00	1.26	13.6
26	1.91	68	0.70	5.7		3.20*e*		13.6*e*
27		68*e*	0.75	6.4	0.55	3.30		13.6*e*
28	1.92	69		6.4*e*	0.45	2.40	1.26	13.6
29		56*e*	0.75	6.4	0.56	3.30		15.8*e*
30	1.67	43	0.75	6.4	0.70	4.80	1.36	17.0
31		40*e*				6.20*e*		

e Discharge estimated.
s Shifting conditions, May 10 to Aug. 7

DAILY GAUGE HEIGHT AND DISCHARGE of Etzikom coulee near Goddard, for 1916—*Concluded*

Day	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1		16.0*e*		8.0		14.3*e*	1.57	27*s*
2		15.1*e*		7.7	1.26	13.6	1.50	27
3	1.31	14.2		7.5		18.8*e*		34*e*
4		14.0*e*		7.2	1.51	24.0	1.65	41*s*
5		13.8*e*		6.9		28.0*e*	1.65	41
6		13.6*e*	0.96	6.6		32.0*e*		39*e*
7	1.31	13.4		6.2*se*		36.0*e*		36*e*
8		14.9*e*	0.92	5.7		40.0*e*	1.55	34
9	1.41	16.4		5.9*e*		44.0*e*	1.54	33
10		16.3*e*		6.1*e*		49.0*e*	1.52	32
11		16.2*e*		6.2*e*		53.0*e*	1.52	32
12		16.1*e*		6.4*e*		57.0*e*		30*e*
13		16.0*e*	0.97	6.6		61.0*e*		29*e*
14		15.9*e*		7.9*e*		65.0*e*	1.46	28
15		15.8*e*		9.2*e*		69.0*e*	1.45	28
16	1.41	15.7		10.5*e*	2.11	73.0		28*e*
17		15.7*e*		11.8*e*	2.11	73.0	1.45	28
18	1.42	15.7		13.1*e*		69.0*e*		28*e*
19		15.5*e*		14.4*e*		64.0*e*	1.45	28
20		15.3*e*	1.32	15.7		60.0*e*		28*e*
21		15.0*e*		15.7*e*		55.0*e*	1.45	28
22		14.8*e*		15.7*e*		51.0*e*	1.45	28
23	1.32	14.6		15.7*e*	1.85	47.0		28*e*
24		15.7*e*		15.7*e*	1.80	43.0	1.45	28
25		13.9*e*		15.7*e*	1.78	42.0		28*e*
26		13.0*e*		15.7*e*	1.90	52.0	1.45	28
27		12.2*e*	1.32	15.7		46.0*e*		28*e*
28		11.3*e*		15.9*e*	1.75	39.0	1.45	28
29		9.5*e*	1.33	16.1		38.0*e*	1.50	31
30	1.12	8.6		15.5*e*	1.70	36.0	1.50	31
31		8.3*e*	1.30	15.9				31*e*

e Discharge estimated.
s Shifting conditions, May 10 to Aug. 7; Oct. 1 to Oct. 4.

MONTHLY DISCHARGE of Etzikom coulee near Goddard, for 1916

(Drainage area 714 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (13-31)	118.0	40.0	85.0	0.119	0.08	3,203
April	40.0	5.7	19.7	0.028	0.03	1,172
May	13.6	1.3	3.6	0.005	0.01	221
June	35.0	7.6	15.9	0.022	0.24	946
July	16.4	8.3	14.3	0.020	0.02	879
August	16.1	5.7	11.0	0.015	0.02	676
September	73.0	13.6	46.0	0.064	0.07	2,737
October	41.0	27.0	31.0	0.043	0.05	1,906
The period					0.52	11,740

IRRIGATION CREEK AT JACQUES' RANCH

Location.—On the SE. ¼ Sec. 35, Tp. 5, Rge. 7, W. 4th Mer., at Chas. Jacques' ranch near Orion, Alberta.

Records available.—March 21 to October 31, 1916.

Gauges.—A temporary gauge was maintained from March 21 to May 18 at a section about one-quarter mile above present gauge; zero of present gauge is 94.30 feet.

Bench-mark.—Permanent iron bench-mark, located 780 feet from north quarter-section line and 750 feet from east quarter-section line; assumed elevation 100.00 feet.

Discharge measurements.—Made with current-meter by wading or from temporary cable car, or with a weir depending on stage of creek.

Observer.—Chas. Jacques.

DISCHARGE MEASUREMENTS of Irrigation creek at Jacques' ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 18	L J Gleeson	12.5	8.34	0.75	.....	6.30
Mar. 21	do	22.8	30.60	0.76	1.80*x*	23.00
Mar. 28	do	3.3	1.55	0.19	0.85*x*	0.80
April 9	do	.....	.....	.....	0.72*x*	Nil
May 6	H W Rowley	.....	.....	.....	.....	Nil
May 18	do	.....	.....	.....	.....	Nil
June 15	do	7.0	2.60	1.42	1.46	3.70
July 11	do	.....	.....	.....	1.42	2.90*w*
Aug. 2	do	.....	.....	.....	.....	Nil
Aug. 21	do	.....	.....	.....	0.34	Nil
Sept. 15	do	.....	.....	.....	.....	Nil
Oct. 5	do	.....	.....	.....	.....	Nil

x Temporary station.
w Discharge determined by using a 36-inch weir.

DAILY GAUGE HEIGHT AND DISCHARGE of Irrigation creek at Jacques' ranch, for 1916

Day	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	0.90	1.40	.....	Nil	1.30	1.20
2	.....	.....	0.70	Nil	.....	"	1.13	0.48
3	.....	.....	0.70	"	.....	"	1.00	0.20
4	.....	.....	0.70	"	.....	"	0.98	0.18
5	.....	.....	.....	"	.....	"	0.98	0.18
6	.....	.....	.....	"	.....	"	0.96	0.15
7	.....	.....	.....	"	.....	"	0.96	0.15
8	.....	.....	.....	"	.....	"	0.96	0.15
9	.....	.....	.....	"	.....	"	0.96	0.15
10	.....	.....	.....	"	.....	"	2.04	16.50
11	.....	.....	.....	"	.....	"	3.50	54.00
12	.....	.....	.....	"	.....	"	2.90	38.00
13	.....	.....	.....	"	.....	"	2.00	15.50
14	.....	.....	.....	"	.....	"	1.50	4.50
15	.....	.....	.....	"	.....	"	1.40	2.60
16	.....	.....	.....	"	.....	"	1.30	1.20
17	.....	.....	.....	"	.....	"	1.30	1.20
18	.....	.....	.....	"	.....	" *x*	1.25	0.92
19	.....	.....	.....	"	.....	"	1.23	0.83
20	.....	.....	.....	"	.....	"	1.15	0.53
21	1.80	23.00	.....	"	.....	"	1.12	0.45
22	1.60	18.00	.....	"	.....	"	1.04	0.27
23	1.50	15.40	.....	"	.....	"	1.04	0.27
24	1.50	15.40	.....	"	.....	"	1.04	0.27
25	1.40	12.80	.....	"	.....	"	1.04	0.27
26	1.20	7.80	.....	"	.....	"	1.04	0.27
27	0.90	1.40	.....	"	.....	"	1.04	0.27
28	0.90	1.40	.....	"	.....	"	1.02	0.24
29	0.90	1.40	.....	"	0.65	"	1.90	13.10
30	0.80	0.50	.....	"	0.80	0.05	1.90	13.10
31	0.80	0.50	.....	.....	1.70	8.60	.....	.....

x Permanent station gauge rod used after May 18.

DAILY GAUGE HEIGHT AND DISCHARGE of Irrigation creek at Jacques' ranch, for 1916.—*Concluded.*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.65	7.50	0.92	0.12	.....	Nil	.....	Nil
2	1.62	6.90	0.85	0.07	.....	"	.....	"
3	1.50	4.50	0.76	0.03	.....	"	.....	"
4	2.08	17.40	0.71	0.01	.....	"	.....	"
5	1.68	8.20	0.65	Nil	.....	"	.....	"
6	1.50	4.50	.....	"	.....	"	.....	"
7	1.47	3.90	.....	"	.....	"	.....	"
8	1.75	9.70	.....	"	.....	"	.....	"
9	1.60	6.50	.....	"	.....	"	.....	"
10	1.50	4.50	.....	"	.....	"	.....	"
11	1.42	3.00	.....	.....	.....	.....	.....	"
12	1.18	0.63	.....	.....	.....	"	.....	"
13	1.04	0.27	.....	"	.....	"	.....	"
14	1.00	0.20	.....	"	.....	"	.....	"
15	0.96	0.15	.....	"	.....	"	.....	"
16	0.92	0.12	.....	"	.....	"	.....	"
17	0.84	0.07	.....	"	.....	"	.....	"
18	0.84	0.07	.....	"	.....	"	.....	"
19	0.90	0.10	.....	"	.....	"	.....	"
20	0.90	0.10	.....	"	.....	"	.....	"
21	0.84	0.07	0.34	" *d*	.....	"	.....	"
22	0.77	0.04	.....	"	.....	"	.....	"
23	0.77	0.04	.....	"	.....	"	.....	"
24	0.75	0.03	.....	"	.....	"	.....	"
25	0.67	Nil	.....	"	.....	"	.....	"
26	0.65	"	.....	"	.....	"	.....	"
27	1.53	5.10	.....	"	.....	"	.....	"
28	1.25	0.92	.....	"	.....	"	.....	"
29	1.02	0.24	.....	"	.....	"	.....	"
30	1.02	0.24	.....	"	.....	"	.....	"
31	0.97	0.16	.....	"	.....	.....	.....	"

d Actual measurement.

MONTHLY DISCHARGE of Irrigation creek at Jacques' ranch, for 1916

(Drainage area 85 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (21-31)	23.00	0.50	8.90	0.105	0.04	194
April	1.40	Nil	0.04	0.000	0.00	2
May	8.60	"	0.28	0.003	0.00	17
June	54.00	0.15	5.60	0.066	0.07	333
July	17.40	Nil	2.70	0.032	0.04	166
August	0.12	"	0.01	0.000	0.00	0
September	Nil	"	Nil	0.000	0.00	0
October	"	"	"	0.000	0.00	0
The period	.....	.....	.....	.....	0.15	712

HOOPER AND HUCKVALE NORTH DITCH FROM MANYBERRIES CREEK

Location.—On the SW. ¼ Sec. 27, Tp. 4, Rge. 6, W. 4th Mer.
Records available.—From May 2, 1912, to October 9, 1916.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.
Discharge measurements.—Made with current-meter by wading.
Observer.—Sidney Hooper.
Gauge.—Vertical staff; zero elevation maintained at 93.35 feet since establishment.

DISCHARGE MEASUREMENTS of Hooper and Huckvale North ditch from Manyberries creek, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 16	L. J. Gleeson	9.3	8.45	0.86	2.53	7.30
Mar. 22	do	10.2	18.60	1.24	3.04	23.00
Mar. 22	do	9.9	15.80	1.06	2.86	16.90
Mar. 29	do	10.9	16.60	0.85	2.75	14.00
April 4	do	10.5	14.60	0.56	2.54	8.10
April 10	do	9.3	8.95	0.58	2.38	5.30
May 5	H. W. Rowley	.....	.....	.....	1.74	0.36*w*
May 18	do	.....	.....	.....	1.51	Nil
June 14	do	10.0	8.80	1.32	2.65	11.60
July 10	do	6.0	2.60	0.83	2.14	2.20
July 31	do	6.0	2.50	0.78	2.09	1.96
Aug. 19	do	.....	.....	.....	1.94	1.61*w*
Sept. 14	do	.....	.....	.....	1.89	1.87
Oct. 6	do	.....	.....	.....	1.64	Nil

w Discharge determined by using a weir.

DAILY GAUGE HEIGHT AND DISCHARGE of Hooper and Huckvale North ditch from Manyberries creek, for 1916

Day	February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	2.27	4.1	2.60	9.90	1.84	0.80	2.70	12.4
2	.....	.....	2.30	4.5	2.64	10.90	1.84	0.80	2.79	15.0
3	.....	.....	2.26	4.0	2.62	10.40	1.80	0.62	2.66	11.4
4	.....	.....	2.17	3.1	2.54	8.60	1.78	0.54	2.52	8.1
5	.....	.....	2.34	5.1	2.45	6.80	1.76	0.46	2.41	6.2
6	.....	.....	2.22	3.6	2.36	5.40	1.74	0.38	2.44	6.6
7	.....	.....	.....	6.0*e*	2.28	4.30	1.72	0.30	2.62	10.4
8	.....	.....	.....	8.0*e*	2.30	4.50	1.72	0.30	2.53	8.2
9	.....	.....	.....	10.0*e*	2.34	5.10	1.71	0.26	2.30	4.5
10	.....	.....	2.87	17.4	2.43	6.50	1.69	0.19	2.38	5.7
11	.....	.....	3.81	49.0	2.69	12.10	1.68	0.15	3.19	3.3
12	.....	.....	3.87	51.0	.....	9.90*e*	1.64	0.04	2.65	11.1
13	.....	.....	3.35	34.0	2.50	7.70	1.62	0.02	2.48	7.3
14	.....	.....	2.84	16.5	2.39	5.80	1.59	Nil	2.63	10.6
15	.....	.....	2.38	5.7	2.40	6.00	.....	"	2.57	9.2
16	.....	.....	2.67	11.6	.....	5.50*e*	.....	"	.....	8.0*e*
17	.....	.....	2.67	11.6	2.34	5.10	.....	"	.....	6.0*e*
18	.....	.....	2.74	13.5	2.23	3.70	.....	"	2.25	3.9
19	.....	.....	2.43	6.5	2.18	3.20	.....	"	2.26	4.0
20	2.57	9.2	2.99	21.0	2.12	2.60	.....	"	3.05	23.0
21	2.73	13.2	3.32	32.0	2.08	2.20	.....	"	2.55	8.8
22	2.46	7.0	3.12	26.0	2.06	2.10	.....	"	2.24	3.8
23	2.11	2.5	3.07	24.0	2.01	1.76	.....	"	2.36	5.4
24	2.10	2.4	3.09	25.0	1.96	1.44	.....	"	2.30	4.5
25	2.75	13.8	2.97	21.0	1.94	1.32	.....	"	2.32	4.8
26	2.62	10.4	2.72	13.0	1.91	1.16	.....	"	2.34	5.1
27	.....	8.8*e*	3.06	24.0	1.89	1.05	2.26	4.00	2.43	6.5
28	2.47	7.2	2.90	18.4	1.85	0.85	2.37	5.50	2.50	7.7
29	2.27	4.1	2.77	14.4	1.84	0.80	2.51	7.90	2.45	6.8
30	.....	.....	2.72	13.0	1.84	0.80	3.15	27.00	2.43	6.5
31	.....	.....	2.60	9.9	.....	.....	2.88	17.80	.....	.....

e Discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of Hooper and Huckvale North ditch from Manyberries creek, for 1916—*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.39	5.80	2.05	2.00	.....	Nil	.....	1.60*e*
2	2.21	3.50	2.01	1.80	.....	"	.....	1.80*e*
3	2.51	7.90	1.98	1.57	.....	.....	.....	2.00*e*
4	2.83	16.20	1.96	1.44	3.48	38.00	.....	2.20*e*
5	2.63	10.60	1.94	1.32	3.12	26.00	.....	2.40*e*
6	2.53	8.20	1.91	1.16	2.54	8.60	.....	2.50*e*
7	.....	6.80*e*	.....	1.16*e*	2.28	4.30	.....	2.60*e*
8	2.37	5.50	1.91	1.16	2.23	3.70	2.12	2.60
9	2.16	3.00	1.93	1.27	.....	3.50	2.09	2.30
10	2.14	2.80	2.06	2.10	2.22	3.60	.....	.....
11	2.14	2.80	2.11	2.50	2.13	2.70	.....	.....
12	2.11	2.50	1.98	1.57	2.01	1.76	.....	.....
13	2.12	2.60	1.84	0.80	.....	1.48*e*	.....	.....
14	2.12	2.60	1.81	0.67	1.92	1.21	.....	.....
15	2.08	2.20	1.76	0.46	1.88	1.00	.....	.....
16	1.92	1.21	1.71	0.26	1.86	0.90	.....	.....
17	1.88	1.00	1.66	0.08	1.83	0.76	.....	.....
18	2.73	13.20	1.70	0.22	.....	0.76*e*	.....	.....
19	2.41	6.20	1.67	0.12	.....	0.76*e*	.....	.....
20	2.18	3.20	1.98	1.57	.....	0.90*e*	.....	.....
21	2.16	3.00	1.81	0.67	.....	1.10*e*	.....	.....
22	2.16	3.00	1.75	0.42	.....	1.10*e*	.....	.....
23	2.14	2.80	1.64	0.04	.....	1.15*e*	.....	.....
24	2.12	2.60	1.58	Nil	.....	1.20*e*	.....	.....
25	2.11	2.50	1.53	"	.....	1.25*e*	.....	.....
26	2.40	6.00	1.52	"	.....	1.30*e*	.....	.....
27	2.21	3.50	1.48	"	.....	1.35*e*	.....	.....
28	2.17	3.10	.....	"	.....	1.40*e*	.....	.....
29	2.16	3.00	.....	"	.....	1.45*e*	.....	.....
30	2.13	2.70	.....	"	.....	1.50*e*	.....	.....
31	2.09	2.30	.....	"	.....	.....	.....	.....

e Discharge estimated.

MONTHLY DISCHARGE of Hooper and Huckvale North ditch from Manyberries creek, for 1916

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
February (20-29)	13.8	2.40	7.90	.....	.....	157
March	51.0	3.10	16.30	.....	.....	1,002
April	12.1	0.80	4.90	.....	.....	292
May	27.0	Nil	2.20	.....	.....	135
June	23.0	3.30	7.80	.....	.....	464
July	16.2	1.00	4.60	.....	.....	283
August	2.5	Nil	0.79	.....	.....	49
September	38.0	"	3.80	.....	.....	226
October (1-9)	2.6	1.60	2.20	.....	.....	39
The period	.....	.....	.....	.....	.....	2,647

MANYBERRIES CREEK AT HOOPER AND HUCKVALE'S RANCH

Location.—On the SW. ¼ Sec. 27, Tp. 4, Rge. 6, W. 4th Mer.

Records available.—April 1, 1911, to September 30, 1916.

Gauge.—Vertical staff; zero maintained at elevation 87.00 feet since establishment.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—The stream flows in one channel except in very high stages; bed consists of sand, clay and gravel.

Discharge measurements.—With current-meter; at low stages made by wading, at high stages a portable cable and cable car is used.

Diversions.—Hooper and Huckvale's north ditch diverts water about one-half mile above this station and the south ditch about one-half mile below.

Observer.—Sidney Hooper.

Remarks.—Creek still flowing after September 30, but no gauge height records obtained except for October 8 and 9.

DISCHARGE MEASUREMENTS of Manyberries creek at Hooper and Huckvale's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 15	L. J. Gleeson	24.3	16.3	1.16	3.81	19.00
Mar. 16	do	31.0	53.9	1.14	4.85	62.00
Mar. 20	do	44.2	91.22	1.95	5.75	178.00
Mar. 27	do	46.2	98.93	1.64	5.67	160.00
Mar. 29	do	10.1	7.0	1.83	2.76	12.80
April 4	do	5.1	0.98	0.61	1.83	0.60
April 5	do	.....	.....	.....	1.74	0.112*w*
April 7	do	.....	.....	.....	1.67	0.046*w*
April 10	do	.....	.....	.....	1.71	0.076*w*
May 5	H. W. Rowley	.....	.....	.....	1.68	0.05*w*
May 18	do	.....	.....	.....	1.68	Nil
June 14	do	11.0	4.8	1.84	2.82	8.80
July 10	do	6.0	2.5	1.64	2.16	4.10
July 31	do	5.0	1.7	1.65	1.97	2.80
Aug. 19	do	.....	.....	.....	1.72	Nil
Sept. 14	do	.....	.....	.....	1.66	Nil
Oct. 6	do	.....	.....	.....	1.66	Nil

w Discharge measured with 15-inch weir on April 5, 7 and 10; with 6-inch weir on May 5.

DAILY GAUGE HEIGHT AND DISCHARGE of Manyberries creek at Hooper and Huckvale's ranch, for 1916

DAY	February		March		April		May	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	2.68	.....	2.03	3.10	1.67	0.35
2	.....	.....	2.50	.....	2.07	3.50	1.67	0.35
3	.....	.....	2.22	.....	2.00	2.80	1.67	0.35
4	.....	.....	.....	.....	2.88	15.10	1.67	0.35
5	.....	.....	.....	.....	1.73	0.65	1.67	0.35
6	.....	.....	.....	.....	1.70	0.50	1.67	0.35
7	.....	.....	.....	.....	1.69	0.45	1.67	0.35
8	.....	.....	.....	.....	1.70	0.50	1.67	0.35
9	.....	.....	.....	.....	1.70	0.50	1.67	0.35
10	.....	.....	5.67	.....	1.71	0.55	1.67	0.35
11	.....	.....	10.63	.....	2.08	3.60	1.67	0.35
12	.....	.....	10.92	.....	.....	2.20*e*	1.67	0.35
13	.....	.....	9.84*x*	.....	1.75	0.75	1.67	0.35
14	.....	.....	.....	.....	1.69	0.45	1.67	0.35
15	.....	.....	2.50	13.00	1.67	0.35	1.67	0.35
16	.....	.....	4.56	51.00	.....	0.40*e*	1.67	0.35
17	.....	.....	4.39	50.00	1.69	0.45	1.67	0.35
18	.....	.....	4.51	57.00	1.70	0.50	1.67	0.35
19	.....	.....	4.01	42.00	1.70	0.50	1.66	0.30
20	3.95*x*	.....	6.89	445.00	1.71	0.55	1.66	0.30
21	4.34	.....	6.95	459.00	1.66	0.30	1.66	0.30
22	4.70	.....	5.52	134.00	1.66	0.30	1.66	0.30
23	5.05	.....	5.64	156.00	1.67	0.35	1.66	0.30
24	4.33	.....	3.09	19.50	1.69	0.45	1.66	0.30
25	3.66	.....	3.08	19.30	1.68	0.40	1.66	0.30
26	3.59	.....	2.57	9.80	1.68	0.40	1.66	0.30
27	.....	.....	5.56	141.00	1.68	0.40	3.03	8.20
28	3.51	.....	3.61	32.00	1.68	0.40	2.29	6.00
29	3.95	.....	2.66	11.30	1.67	0.35	1.93	2.10
30	.....	.....	2.37	7.00	1.67	0.35	7.33	548.00
31	.....	.....	2.20	4.90	.....	.....	4.43	58.00

x Gauge heights February 20 to March 13 affected by snow; not reliable
e Discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of Manyberries creek at Hooper and Huckvale's ranch, for 1916—*Concluded*

DAY	June		July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.41	7.50	2.05	2.20	1.70	0.50	1.70	0.50		
2	2.85	14.60	1.95	1.40	1.70	0.50	1.70	0.50		
3	2.33	6.50	3.85	36.00	1.70	0.50		328.00*e*		
4	1.91	1.90	6.80	403.00	1.70	0.50	7.80	659.00		
5	1.83	1.24	3.33	23.00	1.69	0.45	5.78	185.00		
6	1.82	1.16	2.45	7.50	1.69	0.45	3.01	17.80		
7	2.26	5.60		5.40*e*		0.45*e*	2.30	6.10		
8	1.87	1.56	2.10	3.40	1.69	0.45	1.96	2.40	2.22	5.1
9	2.77	13.20	2.40	7.40	1.70	0.50		1.45*e*	2.14	4.2
10	2.80	13.70	2.16	4.10	2.22	5.10	1.70	0.50		
11	9.28	1,007.00	2.03	3.10	2.03	3.10	1.70	0.50		
12	6.02	241.00	1.96	2.40	1.84	1.32	1.70	0.50		
13	3.44	27.00	1.87	1.56	1.72	0.60		0.50		
14	2.71	7.00	1.81	1.08	1.70	0.50	1.70	0.50		
15	2.48	4.50	1.72	0.60	1.70	0.50	1.68	0.40		
16		*e*4.00	1.72	0.60	1.70	0.50	1.68	0.40		
17		*e*3.50	1.75	0.75	1.70	0.50	1.67	0.35		
18	2.30	3.00	7.48	584.00	1.70	0.50	1.66	0.30		
19	2.33	3.50	6.62	382.00		0.55*e*	1.66	0.30		
20	6.29	243.00	3.30	24.00	1.72	0.60	1.66	0.30		
21	2.93	12.00	2.38	7.10	1.70	0.50	1.66	0.30		
22	2.43	5.30	2.24	5.40	1.70	0.50	1.66	0.30		
23	3.53	25.00	2.21	5.00	1.70	0.50	1.66	0.30		
24	2.49	6.20	1.96	2.40	1.69	0.45	1.66	0.30		
25	2.14	2.50	1.91	1.90	1.70	0.50	1.66	0.30		
26	2.03	1.60	5.84	199.00	1.70	0.50	1.66	0.30		
27	2.08	2.20	4.57	64.00	1.70	0.50	1.66	0.30		
28	2.07	2.20	3.00	17.60	1.70	0.50	1.66	0.30		
29	1.95	1.00	2.26	5.60	1.70	0.50	1.66	0.30		
30	1.95	1.00	2.01	2.90	1.70	0.50	1.66	0.30		
31			1.98	2.60	1.70	0.50				

e Discharge estimated.

MONTHLY DISCHARGE of Manyberries creek at Hooper and Huckvale's ranch for 1916

(Drainage area 142 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (15-31)	459.00	4.90	97.00	0.683	0.43	3,276
April	15.10	0.35	1.37	0.010	0.01	82
May	548.00	0.30	21.00	0.148	0.17	1,291
June	1,007.00	1.00	56.00	0.394	0.44	3,332
July	584.00	0.60	58.00	0.409	0.47	3,566
August	5.10	0.45	0.76	0.005	0.01	47
September	328.00	0.30	40.00	0.282	0.31	2,380
October (8-9)	5.10	4.20	4.60	0.032	0.00	18
The period					1.84	13,992

HOOPER AND HUCKVALE SOUTH DITCH FROM MANYBERRIES CREEK

Location.—On the NE. ¼ Sec. 22, Tp. 4, Rge. 6, W. 4th Mer.
Records available.—March 31, 1914, to October 31, 1916.
Gauge.—Vertical staff; zero elevation maintained at 93.07 feet, since establishment.
Bench-mark.—4-inch x 4-inch post in headgate of ditch; assumed elevation 100.00 feet.
Discharge measurements.—Made with current-meter by wading.
Observer.—Sidney Hooper.
Remarks.—Dam washed out; ditch not used during 1916.

KETCHUM CREEK AT PICKETT'S RANCH

Location.—On the NE. ¼ Sec. 25, Tp. 4, Rge. 7, W. 4th Mer.
Records available.—May 17, 1915, to October 31, 1916.
Gauge.—Vertical staff; zero maintained at elevation 93.98 feet, since establishment.
Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.
Discharge measurements.—Made by wading.
Observer.—C. J. Pickett.
Remarks.—The 1916 rating table used to obtain daily discharges for 1915, which, owing to there being no discharge measurements during 1915, were not computed. These records are published herewith.

DISCHARGE MEASUREMENTS of Ketchum creek at Pickett's ranch, in 1915-16

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
1915		*Feet*	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
June 10	W. H. Storey				Dry	Nil
June 30	do				"	"
July 7	do				"	"
July 28	do				1.40	....*x*
Aug. 16	do				Dry	Nil
Sept. 1	do				"	"
Sept. 22	do				"	"
Oct. 11	do				"	"
Oct. 23	do				"	"
1916						
Mar. 17	L. J. Gleeson	23.8	12.38	0.77	2.80	9.50
Mar. 20	do	24.4	14.24	0.74	2.78	10.60
Mar. 29	do	15.6	11.10	0.58	2.44	6.40
April 5	do	3.2	1.19	0.56	1.67	0.67
May 6	H. W. Rowley				0.92	Nil
May 18	do				0.70	"
June 14	do	8.5	5.83	0.63	2.10	3.70
July 10	do				2.60	0.20*w*
July 31	do				2.66	Nil
Aug. 19	do				2.06	"
Sept. 14	do				2.42	"
Oct. 5	do				2.15	"
Nov. 20	do					....*i*

x Small trickle, too small to measure.
i Pools frozen.
w Discharge taken with 12-inch weir.

DAILY GAUGE HEIGHT AND DISCHARGE of Ketchum creek at Pickett's ranch, for 1915

DAY	May		June		July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			Dry	Nil	Dry	Nil	Dry	Nil	Dry	Nil	Dry	Nil
2			"	"	"	"	"	"	"	"	"	"
3			"	"	"	"	"	"	"	"	"	"
4			"	"	"	"	"	"	"	"	"	"
5												
6			"	"	"	"	"	"	"	"	"	"
7			"	"	"	"	"	"	"	"	"	"
8			"	"	"	"	"	"	"	"	"	"
9			"	"	"	"	"	"	"	"	"	"
10			"	"	"	"	"	"	"	"	"	"
11			"	"	"	"	"	"	"	"	"	"
12			"	"	"	"	"	"	"	"	"	"
13			"	"	"	"	"	"	"	"	"	"
14			"	"	2.25	4.60	"	"	"	"	"	"
15			"	"	5.05	41.00	"	"	"	"	"	"
16			"	"	4.62	35.00	"	"	"	"	"	"
17	Dry	Nil	"	"	3.90	25.00	"	"	"	"	"	"
18	1.44	0.81x	"	"	3.28	16.20	"	"	"	"	"	"
19	1.35	0.56	"	"	3.55	20.00	2.55	7.20	"	"	"	"
20	1.35	0.56	"	"	2.44	6.20	4.32	31.00	"	"	"	
21	Dry	Nil	"	"	2.15	4.00	2.82	10.10	"	"	"	"
22	"	"	"	"	1.90	2.60	3.50	19.30	"	"	"	"
23	"	"	"	"	1.80	2.00	2.90	11.10	"	"	"	"
24	"	"	"	"	1.60	1.26	2.40	5.80	"	"	"	"
25	"	"	"	"	1.58	1.20	1.90	2.60	"	"	"	"
26	"	"	"	"	1.50	0.98	1.72	1.68	"	"	"	"
27	"	"	"	"	1.43	0.78	1.65	1.42	"	"	"	"
28	"	"	"	"	1.40	0.70	1.62	1.32	"	"	"	"
29	"	"	"	"	Dry	Nil	1.51	1.01	"	"	"	"
30	"	"	"	"	"	"	1.45	0.84	"	"	"	"
31	"	"			"	"	1.40	0.70			"	"

x Discharge rating table for 1916 used to compute daily discharge for May 17 to Oct. 31, 1915.

DAILY GAUGE HEIGHT AND DISCHARGE of Ketchum creek at Pickett's ranch, for 1916

DAY	February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			2.10	3.60	2.00	3.00	Dry	Nil	2.96	11.80
2			2.08	3.50	1.94	2.80	"	"	2.42	6.00
3			2.04	3.20	1.92	2.60	"	"	1.90	2.60
4			1.08	0.13	1.93	2.70	"	"	1.69	1.56
5			Dry	Nil	1.67	1.49	"	"	1.65	1.42
6			"	"	1.67	1.49	0.92	"	1.59	1.23
7			"	"	1.58	1.20	0.90	"	1.55	1.12
8			"	"	1.51	1.01	0.88	"	1.48	0.92
9			3.05	13.00	1.41	0.73	0.85	"	1.40	0.70
10			5.09	42.00	1.40	0.70	0.84	"	1.50	0.98
11			12.17	141.00	1.39	0.67	0.76	"	2.68	8.50
12			9.84	108.00	1.35	0.56	Dry	"	5.44	46.00
13			6.54	62.00	Dry	Nil	"	"	2.87	10.70
14			3.59	21.00	"	"	"	"	2.10	3.60s
15			3.05	13.00	"	"	"	"	2.10	3.50
16			3.09	13.60	"	"	"	"	1.70	1.40
17			2.80	9.90	"	"	"	"	1.60	0.95
18	2.04	3.2	2.07	3.40	"	"	0.70	"	1.53	0.65
19	3.04	12.9	2.59	7.60	"	"	Dry	"	1.40	0.25
20	3.06	13.1	2.78	9.70	"	"	"	"	3.28	12.90
21	4.04	27.0	3.63	21.00	"	"	"	"	4.78	33.00
22	4.08	27.0	3.82	24.00	"	"	"	"	2.63	5.00
23	5.04	41.0	2.95	11.70	"	"	"	"	2.76	6.60
24	5.06	41.0	2.74	9.20	"	"	1.15	0.22	3.27	10.40
25	4.12	28.0	2.49	6.60	"	"	1.16	0.24	2.36	2.50
26	3.07	13.3	2.49	6.60	"	"	1.70	1.60	2.05	1.10
27	3.04	12.9	2.03	3.20	"	"	2.05	3.30	1.85	0.45
28	3.08	13.4	2.99	12.20	"	"	2.34	5.30	1.75	0.10
29	2.13	3.8	2.04	3.20	"	"	1.98	3.00	1.68	Nil
30			2.33	5.20	"	"	3.70	22.00	1.64	"
31			2.00	3.00			4.68	36.00		

s Shifting conditions, June 14 to Oct. 31.

DAILY GAUGE HEIGHT AND DISCHARGE of Ketchum creek at Pickett's ranch, for 1916—*Concluded*

Day	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.68	Nil	2.60	Nil	1.65	Nil	2.09	Nil
2	1.60	"	2.56	"	1.64	"	2.10	"
3	4.36	18.60	2.50	"	1.63	"	2.12	"
4	7.30	59.00	2.47	"	1.75	"	2.15	"
5	4.51	18.90	2.40	"	1.85	"	2.15	"
6	3.02	2.60	2.40	"	3.38	3.60	2.15	"
7	2.78	1.35	2.36	"	3.15	2.30	2.15	"
8	2.70	0.85	2.35	"	2.86	1.15	2.16	"
9	2.64	0.50	2.34	"	2.72	0.80	2.20	"
10	2.60	0.20	2.33	"	2.77	0.85	2.23	"
11	2.55	Nil	2.30	"	2.65	0.50	2.25	"
12	2.56	"	2.27	"	2.63	0.40	2.25	"
13	2.46	"	2.26	"	2.56	0.20	2.42	"
14	2.35	"	2.25	"	2.42	Nil	2.70	1.05
15	2.30	"	2.24	"	2.42	"	2.65	0.95
16	2.26	"	2.24	"	2.40	"	2.60	0.85
17	2.35	"	2.25	"	2.35	"	2.56	0.80
18	2.30	"	2.25	"	2.34	"	2.55	0.70
19	4.59	13.70	2.06	"	2.32	"	2.55	0.70
20	3.89	5.00	2.05	"	2.30	"	2.47	0.60
21	3.05	1.10	2.00	"	2.25	"	2.43	0.50
22	2.60	0.10	1.97	"	2.25	"	2.41	Nil
23	2.35	Nil	1.95	"	2.24	"	2.40	"
24	2.45	"	1.95	"	2.20	"	2.40	"
25	2.40	"	1.94	"	2.16	"	2.38	"
26	2.68	0.15	1.92	"	2.15	"	2.38	"
27	2.82	0.30	1.84	"	2.15	"	2.36	"
28	2.86	0.40	1.83	"	2.11	"	2.35	"
29	2.75	0.15	1.81	"	2.10	"	2.35	"
30	2.46	Nil	1.77	"	2.09	"	2.35	"
31	2.66	"	1.70	"	.....	.....	2.35	" *s*

s Shifting conditions, June 14 to Oct. 31.

MONTHLY DISCHARGE of Ketchum creek at Pickett's ranch, for 1915-16

(Drainage area 76 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
1915						
May (17-31)	0.87	Nil	0.13	0.002	0.00	4
June	Nil	"	Nil	Nil	0.00	0
July	41.00	"	5.20	0.068	0.08	320
August	31.00	"	3.00	0.039	0.04	184
September	Nil	"	Nil	Nil	0.00	0
October	"	"	"	"	0.00	0
The period					0.12	508
1916						
February (18-29)	41.00	3.20	19.70	0.259	0.12	469
March	141.00	Nil	18.10	0.238	0.27	1,113
April	3.00	"	0.63	0.008	0.01	37
May	36.00	"	2.30	0.030	0.03	141
June	46.00	"	5.90	0.780	0.09	351
July	59.00	"	4.00	0.053	0.06	246
August	Nil	"	Nil	Nil	0.00	000
September	3.60	"	0.33	0.004	0.00	20
October	1.05	"	0.20	0.003	0.00	12
The period					0.58	2,389

MISCELLANEOUS DISCHARGE MEASUREMENTS made in Pakowki Lake drainage basin, in 1916

Date	Engineer	Stream	Location	Width	Area of Section	Mean Velocity	Discharge
				Feet	*Sq. ft.*	*Ft. per sec.*	*Sec.-ft.*
Mar. 22	L. J. Gleeson	Canal creek	SW.-27-3-6-4	13.40	6.36	0.57	3.60
Mar. 25	do	" "	"	14.2	6.35	0.22	1.41
April 4	do	" "	"	2.4	3.24	0.26	0.85
April 11	do	" "	"				Nil
May 18	H. W. Rowley	" "	"				"
June 13	do	" "	"	16.5	6.67	1.04	6.90
July 8	do	" "	"	17.0	9.10	0.74	6.10
July 31	do	" "	"				Nil
Aug. 19	do	" "	"				"
Sept. 14	do	" "	"				"
Oct. 3	do	" "	"				"
Nov. 3	do	" "	"				"
Mar. 27	L. J. Gleeson	South branch Many-berries creek	SW.-7-5-5-4	12.4	13.30	1.07	14.20
April 7	do	" "	"				0.13*w*

w Discharge determined by using a 15-inch weir.

SAGE CREEK DRAINAGE BASIN

General Description

Sage creek is a small stream of little importance which rises in Township 5, Range 4, West of the 4th Meridian, and flows southerly, crossing the international boundary in Range 2.

The stream has no definite or permanent source of supply, and derives its discharge principally from the melting snow which accumulates in numerous coulees during the winter months. The period of flow, therefore, is generally confined to the spring months while the melting snow is passing off. Heavy rains sometimes cause a flow, but, the drainage area being absolutely devoid of tree growth, the run-off is very rapid.

After entering the United States, Sage creek spreads out over a large dry lake which has no outlet. This lake is about ten miles long and averages one and one-half miles in width, and lies close to the boundary. The lake is bounded on the south by a low range of hills, and at some time has held two or three feet of water at its deepest parts.

A station was maintained near Wild Horse Police Detachment during 1916.

SAGE CREEK AT WILD HORSE POLICE DETACHMENT

Location.—On the NE. ¼ Sec. 9, Tp. 1, Rge. 2, W. 4th Mer., near Wild Horse Police Detachment.

Records available.—Estimated discharge records for 1910-13, based on discharge measurements made in 1915; from March 28 to October 31, 1916, by usual method of discharge curve and daily gauge heights.

Gauge.—Vertical staff. Zero of gauge maintained at 93.36 feet since establishment.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Discharge measurements.—Made with current-meter by wading, or from highway bridge one-half mile above, or with a weir.

Channel.—Composed of hard clay and well grassed over. Practically permanent.

Observer.—Geo. Sherwood.

Remarks.—During flood stage, about gauge height 5.50 feet, this creek overflows at several points above, draining into sloughs and Milk River lake, never returning to the creek. For this reason the records at this station do not represent the total run-off for this drainage basin.

DISCHARGE MEASUREMENTS of Sage creek at Wild Horse police detachment, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 28	H. W. Rowley	20.5	40.60	0 81	4.14	33.0*m*
Mar. 29	do	12 5	51.70	0.97	4.74	50.0*m*
April 6	do	10.0	8.80	0.59	2.47	5.2*n*
April 8	do	10.0	8.00	0.50	2.39	4.0*n*
April 13	do	10.5	12.60	0.76	2.79	9.5*n*
May 3	do	.....	.....	.....	1.76	Nil
May 16	do	.....	.....	.....	Dry	Nil
June 8	do	11.5	5.07	0.47	2.24	2.4*n*
July 6	do	13.5	66.60	1.05	5.53	70.0*m*
July 27	do	11.0	3.80	0.63	2.28	2.4*n*
Aug. 16	do	13.0	6.20	0.56	2.46	3.5*n*
Sept. 12	do	13.0	6.70	0.60	2.47	4.0*n*
Oct. 1	Newhall and Rowley	.....	.....	.....	1.45	Nil
Nov. 1	H. W. Rowley	.....	.....	.....	1.73	Nil

m Measurement made at miscellaneous sections above gauge.
n Measurement made at miscellaneous sections below gauge.

DAILY GAUGE HEIGHT AND DISCHARGE of Sage creek at Wild Horse police detachment, for 1916

Day	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	.....	30.00*e*	1.80	0.40	5.01	56.00
2	.....	.....	.....	25.00*e*	1.78	0.36	4.33	38.00
3	.....	.....	.....	20.00*e*	1.76	0.32	3.95	30.00
4	.....	.....	.....	10.00*e*	1.75	0.30	3.13	14.30
5	.....	.....	.....	10.00*e*	1.74	0.28	2.58	6.10
6	.....	.....	2.47	5.20*d*	1.72	0.24	2.43	4.30
7	.....	.....	2.44	4.40	.....	Nil	2.35	3.50
8	.....	.....	2.34	3.40	.....	"	2.23	2.40
9	.....	.....	2.29	2.90	.....	"	2.20	2.10
10	.....	.....	2.24	2.50	.....	"	2.17	1.92
11	.....	.....	2.29	2.90	.....	"	2.12	1.62
12	.....	.....	2.39	3.90	.....	"	2.67	7.20
13	.....	.....	2.64	6.80	.....	"	5.10	58.00
14	.....	.....	2.72	7.90	.....	"	4.04	32.00
15	.....	.....	2.64	6.80	.....	"	3.49	21.00
16	.....	.....	2.49	5.00	.....	"	3.30	17.20
17	.....	.....	2.44	4.40	.....	"	3.04	12.80
18	.....	.....	2.49	5.00	.....	"	2.72	7.90
19	.....	.....	2.44	4.40	.....	"	2.50	5.10
20	.....	.....	2.31	3.10	.....	"	2.32	3.20
21	.....	.....	2.21	2.20	.....	"	2.97	11.70
22	.....	.....	2.17	1.92	.....	"	4.84	51.00
23	.....	.....	2.11	1.56	.....	"	4.30	38.00
24	.....	.....	2.06	1.34	.....	"	4.21	36.00
25	.....	.....	2.02	1.18	....	"	4.09	33.00
26	.....	.....	1.94	0.86	.....	"	3.69	24.00
27	.....	.....	1.90	0.70	.....	"	3.14	14.50
28	4.14	33*d*	1.89	0.67	2.53	5.50	2.80	9.00
29	4.74	50*d*	1.89	0.67	3.65	24.00	2.54	5.60
30	.....	.....	1.82	0.46	3.63	23.00	2.38	3.80
31	.....	.....	.....	.....	5.02	56.00	.....	.....

d Actual measurement.
e Discharge estimated from data collected in field.

DAILY GAUGE HEIGHT AND DISCHARGE of Sage creek at Wild Horse police detachment, for 1916. —*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.29	2.90	2.20	2.10	1.68	0.18	1.45	Nil
2	2.19	2.00	2.16	1.86	1.60	0.10	1.40	"
3	3.30	17.20	2.12	1.62	1.52	0.02	.....	"
4	5.44	67.00	2.05	1.30	1.48	Nil	.....	"
5	5.24	62.00	2.00	1.10	1.44	"	.....	"
6	5.14	59.00	1.95	0.90	4.12	34.00	.....	"
7	4.74	48.00	1.90	0.70	5.28	63.00	1.34	"
8	4.34	39.00	1.90	0.70	4.60	45.00	1.79	0.38
9	4.09	33.00	3.15	14.60	3.50	21.00	1.84	0.52
10	3.14	14.50	5.10	58.00	3.00	12.20	1.99	1.06
11	2.99	12.00	4.82	51.00	2.70	7.60	2.09	1.46
12	2.89	10.40	4.30	38.00	2.48	4.90	2.21	2.20
13	2.84	9.60	3.90	29.00	2.42	4.20	2.29	2.90
14	2.74	8.20	3.25	16.40	2.35	3.50	2.37	3.70
15	2.59	6.20	3.18	15.20	2.20	2.10	2.34	3.40
16	2.49	5.00	3.08	13.50	2.12	1.62	2.34	3.40
17	2.44	4.40	3.00	12.20	2.02	1.18	2.27	2.70
18	2.39	3.90	2.70	7.60	2.00	1.10	2.17	1.92
19	2.74	8.20	2.32	3.20	1.96	0.94	2.09	1.46
20	4.64	46.00	2.10	1.50	1.93	0.82	2.04	1.26
21	4.24	36.00	2.04	1.26	1.90	0.70	2.01	1.14
22	3.59	22.00	1.98	1.02	1.85	0.55	1.99	1.06
23	3.14	14.50	1.92	0.78	1.78	0.36	1.97	0.98
24	2.96	11.60	1.85	0.55	1.72	0.24	1.94	0.86
25	2.62	6.60	1.80	0.40	1.68	0.18	1.91	0.74
26	2.39	3.90	1.76	0.32	1.64	0.14	1.89	0.67
27	2.29	2.90	1.85	0.55	1.60	0.10	1.85	0.55
28	2.10	1.50	1.82	0.46	1.56	0.06	1.81	0.43
29	2.05	1.30	1.80	0.40	1.50	Nil	1.79	0.38
30	2.25	2.60	1.75	0.30	1.48	"	1.77	0.34
31	2.22	2.30	1.72	0.24	.....	.....	1.74	0.28

MONTHLY DISCHARGE of Sage creek at Wild Horse police detachment for 1916,

(Drainage area 188 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March	.....	.....	48.00*x*	0.255	0.29	2,951
April	30.0	0.46	5.80	0.031	0.03	345
May	56.0	Nil	3.60	0.019	0.02	221
June	58.0	1.62	18.40	0.098	0.11	1,095
July	67.0	1.30	18.20	0.097	0.11	1,119
August	58.0	0.24	8.90	0.047	0.05	547
September	63.0	Nil	6.90	0.037	0.04	411
October	3.7	Nil	1.09	0.006	0.01	67
The period	.....	.....	.....	.....	0.66	6,756

x Discharge estimated from data collected in the field.

C. A. WILEY WEST DITCH FROM SAGE CREEK

Location.—On the SW. ¼ Sec. 3, Tp. 1, Rge. 2, W. 4th Mer., near Sage Creek post office.
Gauge.—Vertical staff; zero of gauge maintained at 97.10 feet.
Bench-mark.—Same as for Wiley's East ditch.
Discharge measurements.—Made with meter or weir.
Observer.—J. H. Miller.
Remarks.—There was no flow at each of the four visits by the district engineer during 1916, and it is understood that no water has been diverted since the station was established on August 11, 1915.

C. A. WILEY EAST DITCH FROM SAGE CREEK

Location.—On the SW. ¼ Sec. 3, Tp. 1, Rge. 2, W. 4th Mer., near Sage Creek post office.
Gauge.—Vertical staff; zero of gauge maintained at 96.70 feet.
Bench-mark.—Consists of three-fourths inch iron post, 4 feet long with 8-inch right angle bend at lower end. Assumed elevation 100.00 feet, located on the left bank.
Discharge measurements.—Made with current-meter or weir.
Observer.—J. H. Miller.
Remarks.—There was no flow at each of the four visits by the district engineer during 1916, and it is understood that no water has been diverted since the station was established on August 11, 1915.

LODGE CREEK DRAINAGE BASIN

General Description

Lodge creek, which rises in Township 7, Range 3, West of the 4th Meridian, flows in a southerly direction for about twelve miles, then turns southeastward, and crosses the international boundary in Section 4, Township 2, Range 29, West of the 3rd Meridian.

Near its head the valley is very deep and narrow, but it broadens out considerably lower down, giving rise to large flats and meadows. The upper part of the drainage basin is cut up to a great extent by deep coulees, which drain into the creek. This part of the creek is thickly covered with brush along the banks, but lower down it is totally devoid of tree growth. The valley is rather unproductive owing to the absence of moisture, but a few good hay meadows have been developed along its course through the storage of the flood waters and their application to the soil by irrigation. As is the case with many of the streams in this locality, the flow in Lodge creek is not continuous throughout the year, the creek being dry, with the exception of pools of standing water, during the greater part of the summer months. At flood stages the creek carries a considerable amount of water and as a result its channel is wide and well defined throughout the whole length of its course.

The station at Willow Creek Police Detachment was the only station on the main stream maintained during 1916.

ENGLISH DITCH FROM EAST BRANCH OF LODGE CREEK

Location.—On the SW. ¼ Sec. 12, Tp. 7, Rge. 3, W. 4th Mer., 360 feet above two-way gate where first lateral is taken out of main ditch.
Records available.—For the irrigation season of 1916.
Gauge.—Vertical staff driven into bed of the stream near the left bank. Elevation of zero of gauge maintained at 97.69 feet since establishment.
Bench-mark.—Permanent iron bench-mark, located in the left bank near the gauge; assumed elevation 100.00 feet.
Channel.—Composed of gravel and loam.
Discharge measurements.—Made with current-meter or weir.
Observer.—James English.

DISCHARGE MEASUREMENTS of English ditch from East branch of Lodge creek, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
May 8	H. W. Rowley	4.0	2.18	1.06	0.85	2.30
May 20	do	3.8	2.04	0.98	0.74	1.80
June 17	do	.....	.....	.....	Dry	Nil
July 12	do	.....	.....	.....	"	"
Aug. 2	do	.....	.....	.....	"	"
Aug. 22	do	.....	.....	.....	"	"
Sept. 19	do	.....	.....	.....	"	"
Nov. 6	do	.....	.....	.....	"	"

DAILY GAUGE HEIGHT AND DISCHARGE of English ditch from East branch of Lodge creek, for 1916

Day	MAY		MAY			JUNE			JUNE		
	Gauge Height	Discharge	Day	Gauge Height	Discharge	Day	Gauge Height	Discharge	Day	Gauge Height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*
3	1.09*h*	4.1	14	0.84	2.20	3	0.99*h*	3.2	19	0.94*h*	2.8
4	0.92	2.7	15	0.82	2.10	4	0.99	3.2	20	0.94	2.8
5	0.94	2.8	16	0.84	2.20	5	1.04	3.6	21	0.91	2.1
6	0.89	2.5	17	0.79	2.00	6	1.09	4.1	22	0.91	2.6
7	0.89	2.5	18	0.76	1.88	7	1.04	3.6	23	0.91	2.6
8	0.85	2.3	19	0.74	1.80	8	1.00	3.3	24	0.90	2.6
9	0.89	2.5	20	0.74	1.80	9	0.94	2.8	25	0.90	2.6
10	0.89	2.5	21	0.76	1.88	10	0.94*h*	2.8	26	0.90	2.6
11	0.86	2.4	22	0.79	2.00	.....	.....	.....	27	0.90	2.6
12	0.84	2.2	23	0.96	3.00	.....	.....	.....	28	0.90	2.6
13	0.82	2.1	24	0.94*h*	2.80	.....	.....	.....	29	0.94*h*	2.8

h Headgate open May 3 to 24, June 3 to 10 and June 19 to 29.

MONTHLY DISCHARGE of English ditch from East branch of Lodge creek, for 1916

Month	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
May (3-24)	4.1	1.80	2.4	.....	.....	105
June (3-10) and (19-29)	4.1	2.10	2.9	.....	.....	109
The period	.....	.....	.....	.....	.....	214

EAST BRANCH LODGE CREEK AT ENGLISH'S RANCH

Location.—On the SE. ¼ Sec. 1, Tp. 7, Rge. 3, W. 4th Mer., at James English's ranch.

Records available.—October 7, 1911, to October 31, 1916.

Gauge.—Vertical staff. Zero elevation of gauge maintained at 95.38 feet during 1911; zero elevation of gauge maintained at 95.43 feet during 1912; zero elevation of gauge maintained at 95.35 feet during 1913-16.

Bench-mark.—Permanent iron bench-mark, assumed elevation 100.00 feet.

Channel.—Not likely to shift except during floods.

Discharge measurements.—Made with current-meter by wading or with weir.

Winter flow.—Station discontinued during winter season.

Control.—On August 19, 1915, an artificial log control was installed at this station.

Diversions.—Water is diverted for irrigation, about three miles above this station, by James English.

DISCHARGE MEASUREMENTS of East branch of Lodge creek at English's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 29	P. A. Fetterley	10.9	4.83	1.52	2.75	7.40*m*
Mar. 30	do	11.3	6.19	0.55	2.76	3.40*m*
April 10	do	11.5	9.95	1.03	1.59	10.10*m*
April 10	do	11.5	9.95	1.02	1.60	10.20*m*
April 11	do	11.5	10.40	1.22	1.64	12.70*m*
May 8	H. W. Rowley	.....	.....	.....	1.12	1.35*w*
May 20	do	.....	.....	.....	1.02	0.41*w*
June 17	do	13.0	12.00	0.97	1.80	11.60*n*
July 12	do	12.0	7.50	0.41	1.55	3.00*n*
Aug. 3	do	.....	.....	.....	1.43	0.82*w*
Aug. 23	do	.....	.....	.....	1.42	0.73*w*
Sept. 19	do	.....	.....	.....	1.40	0.66*w*
Oct. 8	do	11.0	4.50	1.61	1.56	2.80*m*
Nov. 7	do	5.0	2.60	0.61	1.65*c*	1.59*n*

c Gauge height affected by ice on control.
m Discharge measured at miscellaneous sections above gauge.
n Discharge measured at miscellaneous sections below gauge.
w Discharge measured with a weir.

DAILY GAUGE HEIGHT AND DISCHARGE of East branch of Lodge creek at English's ranch, for 1916

Day	February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	3.65	25.0*e*	2.50	69.0*e*	1.30	3.30	2.37	60.0
2	.....	.....	.....	25.0*e*	2.45	65.0*e*	1.30	3.30	2.35	58.0
3	.....	.....	.....	20.0*e*	2.15	45.0*e*	1.40	4.70	2.30	55.0
4	.....	.....	.....	20.0*e*	2.15	45.0*e*	1.43	5.20	2.25	52.0
5	.....	.....	.....	20.0*e*	2.00	35.0*e*	1.30	3.30	2.40	62.0
6	.....	.....	.....	20.0*e*	1.85	25.0*e*	1.20	2.10	2.35	58.0
7	.....	.....	.....	15.0*e*	1.40	14.70*e*	1.20	2.10	2.20	48.0
8	.....	.....	.....	15.0*e*	1.65	13.20*e*	1.12	1.30	1.65	13.2
9	.....	.....	.....	15.0*e*	1.30	13.30*e*	1.10	1.10	1.55	8.3
10	.....	.....	.....	15.0*e*	1.70*c*	16.20	1.08	0.92	2.76	90.0
11	.....	.....	4.40	45.0*e*	1.65	13.2	1.05	0.66	4.62	323.0
12	.....	.....	4.50	50.0*e*	1.57	9.1	1.05	0.66	2.55	62.0
13	.....	.....	4.55	50.0*e*	1.50	6.7	1.05	0.66	2.30	41.0
14	.....	.....	4.60	60.0*e*	1.45	5.6	1.01	0.34	2.10	28.0
15	.....	.....	4.60	60.0*e*	1.40	4.7	1.01	0.34	2.00	22.0
16	.....	.....	4.60	60.0*e*	1.40	4.7	1.01	0.34	1.90	16.6
17	4.15*c*	40*e*	4.65	50.0*e*	1.40	4.7	1.01	0.34	1.80	11.6
18	4.15	40*e*	4.65	50.0*e*	1.35	4.0	1.01	0.34	1.65	5.0
19	4.25	45*e*	4.70	70.0*e*	1.30	3.3	1.01	0.34	2.12	29.0
20	4.30	50*e*	4.75	70.0*e*	1.40	4.7	1.02	0.42	2.00	22.0
21	4.45	60*e*	4.60	80.0*e*	1.35	4.0	1.03	0.50	1.90	16.6
22	4.55	65*e*	3.95	40.0*e*	1.40	4.7	1.04	0.58	1.80	11.6
23	4.50	65*e*	3.80	25.0*e*	1.30	3.3	1.53	7.70	1.70	6.5
24	4.30	50*e*	3.75	20.0*e*	1.28	3.1	1.70	16.20	1.70	6.5
25	4.25	45*e*	3.60	15.0*e*	1.23	2.5	1.60	10.40	1.70	6.5
26	4.25	45*e*	3.55	7.4*e*	1.20	2.1	1.70	16.20	1.70	6.5
27	4.00	35*e*	3.55	7.4*e*	1.23	2.5	2.88	101.00	1.65	5.0
28	3.85	25*e*	3.55	7.4*e*	1.22	2.3	3.50	168.00	1.60	3.8
29	3.75	25*e*	2.75	7.4*d*	1.28	3.1	3.75	198.00	2.60	66.0
30	.....	.....	2.75	3.4*d*	1.30	3.3	3.66	187.00	2.50	57.0
31	.....	.....	2.60	3.0*e*	.....	.....	2.50	69.00	.....	.....

c–*c* Gauge heights affected by ice.
d Actual measurement
e Discharge estimated from remarks furnished by observer.

DAILY GAUGE HEIGHT AND DISCHARGE of East branch of Lodge creek at English's ranch, for 1916
—*Concluded*

Day	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.00	22.00	1.40	0.62	1.20	0.02	1.45	1.07
2	2.25	38.00	2.10	28.00	1.20	0.02	1.50	1.77
3	2.53	60.00	2.00	22.00	.....	2.50*e*	1.55	2.70
4	2.50	57.00	1.68	5.90	1.65	5.00	1.55	2.70
5	2.25	38.00	1.60	3.80	1.85	14.10	1.56	2.90
6	.....	30.00*e*	.....	3.15*e*	1.75	8.50	1.56	2.90
7	2.00	22.00	1.54	2.50	1.65	5.00	1.58	3.40
8	2.00	22.00	1.50	1.77	1.60	3.80	1.56	2.90
9	1.90	16.60	1.50	1.77	1.55	2.70	1.60	3.80
10	1.80	11.60	1.45	1.07	1.50	1.77	1.58	3.40
11	1.60	3.80	1.45	1.07	1.45	1.07	1.58	3.40
12	1.56	2.90	1.45	1.07	1.45	1.07	1.55	2.70
13	1.50	1.77	1.45	1.07	1.45	1.07	1.53	2.30
14	1.50	1.77	1.45	1.07	1.45	1.07	1.50	1.77
15	.....	1.42*e*	1.50	1.77	1.40	0.62	1.50	1.77
16	1.45	1.07	1.50	1.77	1.40	0.62	1.50	1.77
17	1.45	1.07	1.55	2.70	.....	0.57*e*	1.50	1.77
18	1.70	6.50	1.55	2.70	1.38	0.52	1.50	1.77
19	1.70	6.50	1.50	1.77	1.40	0.62	1.50	1.77
20	1.60	3.80	.....	1.42*e*	1.42	0.80	.....	1 90*e*
21	1.50	1.77	1.45	1.07	1.42	0.80	....	2.00*e*
22	1.50	1.77	1.42	0.80	1.43	0.89	1.52	2.10
23	1.48	1.49	1.40	0.62	1.43	0.89	1.54	2.50
24	1.45	1.07	1.40	0.62	1.43	0.89	1.56	2.90
25	1.45	1.07	1.38	0.52	1.45	1.07	1.56	2.90
26	1.45	1.07	1.35	0.36	1.48	1.49	1.58	3.40
27	1.45	1.07	1.32	0.26	1.50	1.77	1.58	3.40
28	1.45	1.07	1.30	0.19	1.45	1.07	.....	3.05*e*
29	1.43	0.89	1.30	0.19	1.43	0.89	1.55	2.70
30	1.43	0.89	1.20	0.02	1.43	0.89	1.55	2.70
31	1.43	0.89	1.25	0.09	.....	.....	1.55	2.70

e Discharge estimated.

MONTHLY DISCHARGE of East branch of Lodge creek at English's ranch, for 1916

(Drainage area 15.6 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
February (17-29)	.....	.....	45.0*e*	2.880	1.39	1,160
March	.....	.....	31.0*e*	1.990	2.29	1,906
April	69.0	2.10	14.4	0.923	1.03	857
May	198.0	0.34	26.0	1.670	1.92	1,599
June	323.0	3.80	42.0	2.690	3.00	2,499
July	60.0	0.89	11.6	0.744	0.86	713
August	28.0	0.02	3.0	0.192	0.22	184
September	14.1	0.02	2.1	0.135	0.15	125
October	3.8	1.07	2.5	0.160	0.18	154
The period	.....	.....	.....	.....	11.04	9,197

e Discharge estimated.

ANDERSON DITCH FROM EAST BRANCH OF LODGE CREEK

Location.—On the SW. ¼ Sec. 23, Tp. 6, Rge. 3, W. 4th Mer., at intake of Robert Anderson's ditch.

Records available.—For the irrigation season of 1912-1916.

Gauge.—Vertical staff; the elevation of the zero of the gauge was maintained at 97.63 feet during 1912, at 97.64 feet during 1913-14, and at 96.76 feet during 1915-16.

Bench-mark.—A permanent iron bench-mark was installed on the left bank, ten feet from the gauge and permanent weir; assumed elevation 100.00 feet.

Discharge measurements.—Made by measuring the head over a permanent 18-inch sharp crested weir, ten feet below the gauge.

Artificial control.—A permanent sharp crested rectangular weir, ten feet below the gauge; elevation of crest maintained at 97.76 feet.

Observer.—Robert Anderson.

Remarks.—There was no flow at each of five visits by the district engineer during the season of 1916, and it is understood that no water was diverted during 1916.

ROTH DITCH FROM LODGE CREEK

(Formerly called Hanckel ditch near Eagle Butte)

Location.—On NE. ¼ Sec. 30, Tp. 7, Rge. 3, W. 4th Mer., about three-quarters of a mile down stream from intake of ditch.

Gauge.—Vertical staff driven into the bed of the stream near the right bank; zero of the gauge was established and maintained at 98.38 feet.

Bench-mark.—Permanent iron bench-mark on the right bank near the gauge; assumed elevation 100.00 feet.

Channel.—Composed of gumbo.

Discharge measurements.—Made with current-meter or weir.

Remarks.—This station was established on October 4, 1915, but no records have been received. It was visited on June 16, 1916, but there was no flow and no gaugings were made. It is understood, however, that a little water was diverted during the spring.

H. A. MUDIE DITCH FROM SEXTON CREEK

Location.—On the NW. ¼ Sec. 21, Tp. 7, Rge. 3, W. 4th Mer., about one-quarter mile down stream from intake of ditch.

Gauge.—Vertical staff driven into the bed of the ditch near the right bank. The elevation of zero of gauge maintained at 97.16 feet since establishment.

Bench-mark.—Permanent iron bench-mark located near the gauge on the right bank; assumed elevation 100.00 feet.

Channel.—Composed of gumbo.

Discharge measurements.—Made with current-meter or with weir.

Observer.—H. A. Mudie.

Remarks.—This station was established September 28, 1915, by H. R. Carscallen. No records available for 1915. There was no flow at each of five visits by the district engineer during 1916, and it is understood that no water was diverted during 1916.

H. T. CLARK NORTH DITCH FROM SEXTON CREEK

Location.—On the SW. ¼ Sec. 21, Tp. 7, Rge. 3, W. 4th Mer., 430 feet below headgate of irrigation ditch.

Gauge.—Vertical staff driven into the bed of the ditch; elevation of zero maintained at 97.61 feet since establishment.

Bench-mark.—Permanent iron bench-mark located on the right bank near the gauge; assumed elevation 100.00 feet.

Channel.—Composed of sandy loam.

Discharge measurements.—Made with weir or current-meter.

Observer.—T. S. Clark.

Remarks.—Station established September 28, 1915, by H. R. Carscallen. No records were obtained in 1915, and there was no flow at each of seven visits made by the district engineer during 1916.

Ditch was, however, used for about twenty-six days during 1916. Gauge heights obtained, but not sufficient data to compute discharges. The daily discharge was, however, very small.

DAILY GAUGE HEIGHT AND DISCHARGE of H. T. Clark North ditch from Sexton creek, for 1916

JUNE			JUNE			JUNE		
Day	Gauge Height	Discharge	Day	Gauge Height	Discharge	Day	Gauge Height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*
1	0.47*h*	.....*x*	10	.....	.....	19	0.52	.....
2	.....	.....	11	.....	.....	20	.....	.....
3	.....	.....	12	.....	.....	21	.....	.....
4	.....	.....	13	.....	.....	22	0.62	.....
5	0.47	.....	14	.....	.....	23	.....	.....
6	.....	.....	15	.....	.....	24	.....	.....
7	0.47	.....	16	0.47	.....	25	.....	.....
8	.....	.....	17	0.49	.....	26	0.47	.....
9	.....	.....	18	0.52	.....			

h Headgate open June 1-26.
x Insufficient data to compute discharge.
Daily discharge very small.

H. T. CLARK SOUTH DITCH FROM SEXTON CREEK

Location.—On the SW. ¼ Sec. 21, Tp. 7, Rge. 4, W. 4th Mer., 140 feet below intake of ditch.
Records available.—For the irrigation season of 1916.
Gauge.—Vertical staff driven into the bed of the ditch near the left bank. Elevation of zero of gauge maintained at 95.32 feet since establishment.
Bench-mark.—Permanent iron bench-mark located at the north ditch station; assumed elevation 100.00 feet.
Channel.—Composed of sandy loam.
Discharge measurements.—Made with a weir or current-meter.
Observer.—T. S. Clark.
Remarks.—No records obtained in 1915.

DISCHARGE MEASUREMENTS of H. T. Clark South ditch from Sexton creek, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
May 19	H. W. Rowley	.....	.....	.....	0.69	0.60*w*
June 16	do	.....	.....	.....	Dry	Nil
July 11	do	.....	.....	.....	0.45	0.24*w*
Aug. 2	do	.....	.....	.....	Dry	Nil
Aug. 22	do	.....	.....	.....	Dry	Nil
Sept. 16	do	.....	.....	.....	0.43	0.20*w*
Nov. 6	do	.....	.....	.....	Dry	Nil

w Discharge determined by using a 15-inch weir.

DAILY GAUGE HEIGHT AND DISCHARGE of H. T. Clark South ditch from Sexton creek, for 1916

DAY	April		May		June		July		August		September	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	....	.....	.....	0.84*e*	.....	1.43*e*	0.59	0.44	.....	.....	.....	0.55
2	....	.....	.....	0.90*e*	.....	1.54*e*	.....	0.62	.....	.....	.....	0.60
3	....	.....	.....	0.96*e*	.....	1.65*e*	.....	0.80	.....	.....	.....	0.65
4	....	.....	.....	1.02*e*	.....	1.76*e*	0.89	0.99	.....	.....	.....	0.70
5	....	.....	0.94	1.10	1.24	1.87	.....	0.78	.....	.....	0.75	0.70
6	.....	.....	.....	1.02*e*	.....	1.23*e*	.....	0.57	.....	.....	0.55	0.37
7	.....	.....	.....	0.96*e*	0.69	0.60	0.54	0.36	.....	.....	.....	0.33
8	.....	.....	.....	0.88*e*	.....*h*	.....	.....	0.31	.....	.....	.....	0.29
9	.....	.....	.....	0.80*e*	.....	.....	.....	0.26	.....	.....	.....	0.25
10	.....	.....	0.74	0.69	.....	.....	0.44	0.22	.....	.....	.....	0.21
11	.....	.....	.....	0.65*e*	.....	.....	0.45	0.24*d*	.....	.....	0.40	0.17
12	.....	.....	0.69	0.60	.....	.....	.....	0.30	.....	.....	.....	0.17
13	.....	.....	0.69	0.60	.....	.....	.....	0.37	.....	.....	0.40	0.17
14	.....	.....	.....	0.63*e*	.....	.....	0.59	0.44	.....	.....	0.45	0.24
15	.....	.....	.....	0.66*e*	.....*h*	.....	.....	0.50	.....	.....	.....	0.22
16	.....	.....	0.74	0.69	0.54	0.36	.....	0.56	.....	.....	0.43	0.20
17	.....	.....	0.64	0.51	0.69	0.60	.....	0.62	.....	.....	.....	0.19
18	.....	.....	0.69	0.60	0.64	0.51	0.74	0.69	.....	.....	.....	0.18
19	.....	.....	0.69*d*	0.60*d*	0.69	0.60	.....	0.56	.....	.....	0.40	0.17
20	1.04	1.33	.....	0.78*e*	.....	0.66*e*	0.59	0.44	.....	.....	.....	0.20
21	1.05	1.36	.....	0.96*e*	.....	0.72*e*	.....*h*	.....	.....	.....	0.45	0.24
22	.....	1.29*e*	.....	1.14*e*	0.79	0.78	.....	.....	.....	.....	0.43	0.20
23	.....	1.22*e*	1.04	1.33	.....	0.68	.....	.....	.....*h*	.....	.....	0.20
24	.....	1.15*e*	0.94	1.10	.....	0.58	.....	.....	0.40	0.17	.....	0.21
25	0.94	1.10	.....	1.14*e*	.....	0.47	.....	.....	.....	0.22	.....	0.21
26	0.84	0.88	.....	1.18*e*	0.54	0.36	.....	.....	.....	0.27	.....	0.22
27	1.04	1.33	.....	1.22*e*	.....	0.39	.....	.....	.....	0.31	.....	0.23
28	.....	1.10*e*	.....	1.26*e*	.....	0.42	.....	.....	.....	0.36	.....	0.23
29	0.84	0.88	.....	1.30*e*	0.59	0.44	.....	.....	.....	0.40	.....	0.24
30	0.79	0.78	.....	1.31*e*	.....	0.50	.....	.....	.....	0.45	0.45*h*	0.24
31	.....	.....	1.04	1.33	.....	.....	.....	.....	.....	0.50	.....	.....

e Discharge estimated.
h Headgate closed, June 8 to 15, July 21 to August 23, and September 30 to end of season.
d Actual measurement.

MONTHLY DISCHARGE of H. T. Clark South ditch from Sexton creek, for 1916

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
April (20-30)	1.36	0.78	1.13	.....	.....	25
May	1.33	0.51	0.93	.....	.....	57
June (1-7 and 16-30)	1.87	0.36	0.82	.....	.....	36
July (1-20)	0.99	0.22	0.50	.....	.....	20
August (24-31)	0.50	0.17	0.34	.....	.....	5
September	0.70	0.17	0.29	.....	.....	17
The period	.....	.....	.....	.....	.....	160

JOHN READ DITCH FROM MICHEL COULEE

Location.—On the NE. ¼ Sec. 33, Tp. 6, Rge. 3, W. 4th Mer., 90 feet below point of ditch from Michel Coulee.

Gauge.—Vertical staff gauge driven in the bed of the ditch near the left bank; elevation of zero maintained at 95.45 feet since establishment.

Bench-mark.—Top of iron post on the left bank of ditch located near the gauge; assumed elevation 100.00 feet.

Channel.—Composed of gumbo.

Discharge measurements.—Made with a current-meter or with a weir.

Observer.—None.

Remarks.—This station was established by H. R. Carscallen, September 28, 1915. No records available for 1915. There was no flow at each of four visits made by the district engineer during 1916, and it is understood that no water was diverted during 1916.

JOHN READ DITCH FROM READ CREEK

Location.—On the NE. ¼ Sec. 34, Tp. 6, Rge. 3, W. 4th Mer., 300 feet down stream from intake of ditch.

Gauge.—Vertical staff driven into bed of stream near right bank; zero of gauge maintained at 97.30 feet since establishment.

Bench-mark.—Permanent iron bench-mark on the left bank of ditch, near the gauge; assumed elevation 100.00 feet.

Channel.—Composed of sandy loam.

Discharge measurements.—Made with current-meter or with a weir.

Observer.—None.

Remarks.—This station was established September 27, 1915, by H. R. Carscallen. No records available for 1915. There was no flow at each of four visits made by the district engineer during 1916, and it is understood that no water was diverted during 1916.

J. R. HARTT DITCH FROM LODGE CREEK

Location.—On NE. ¼ Sec. 15, Tp. 6, Rge. 3, W. 4th Mer., about one-half mile down stream from intake of irrigation ditch.

Gauge.—Vertical staff fastened to post driven into bed of ditch near right bank; elevation of zero maintained at 97.48 feet.

Bench-mark.—Permanent iron bench-mark located on the right bank near the gauge; assumed elevation 100.00 feet.

Channel.—Composed of gravel and gumbo.

Observer.—J. R. Hartt.

Remarks.—Station established September 27, by H. R. Carscallen; no records obtained during 1915. There was no flow at each of four visits made by the district engineer during the season, and it is understood that very little, if any, water was used during 1916.

LODGE CREEK AT HARTT'S RANCH

Location.—On the NW. ¼ Sec. 10, Tp. 6, Rge. 3, W. 4th Mer., at Ed. Hartt's ranch.

Records available.—July 22, 1909, to June 8, 1915.

Remarks.—This station was discontinued June 8, 1915.

MEAN MONTHLY DISCHARGE in Second-feet of Lodge creek at Hartt's ranch

MONTH	1910–11	1911–12	1912–13	1913–14	1914–15	Mean in Sec.-ft.	Mean in Acre-ft.
October		2.10	Nil	Nil	1.74	0.96	59
November		2.00*b*	" *d*				
December							
January							
February							
March				26.00*e*	43.00*f*		
April	17.5*a*	205.00*c*	87.00	40.00	40.00	56.00	3,314
May	9.1	24.00	12.00	2.80	2.70	10.10	627
June	12.8	2.30	0.87	0.83	42.00*h*	4.20	250
July	6.1	Nil	0.25	Nil		1.60	97
August	Nil	"	Nil	"		Nil	Nil
September	7.7	"	"	"		1.92	115
Total in acre-ft	2,358	12,352	5,988	3,533	4,265		4,462

a 25-30.
b 1-3.
c 5-30.
d 1-15.
e 14-31.
f 21-31.
h 1-8.

A. J. SUISTE NORTH DITCH NEAR EAGLE BUTTE

Location.—On the NE. ¼ Sec. 9, Tp. 6, Rge. 3, W. 4th Mer., one-quarter of a mile below intake of ditch.

Gauge.—Vertical staff driven into the bed of the stream near the left bank. Zero of gauge maintained at 99.88 feet since establishment.

Bench-mark.—Top of three-quarter inch iron post located on the right bank near the gauge; assumed elevation 100.00 feet.

Channel.—Composed of gumbo.

Discharge measurements.—Made with current-meter or weir.

Observer.—J. E. Hartt.

Remarks.—This station was established September 27, 1915, by H. R. Carscallen, too late in the season to obtain records for the irrigation season of 1915. There was no flow at each of the four visits by the district engineer during 1916, and it is understood that no water was diverted during 1916.

A. J. SUISTE SOUTH DITCH NEAR EAGLE BUTTE

Location.—On the NE. ¼ Sec. 4, Tp. 6, Rge. 3, W. 4th Mer., fifty feet below dam and intake of ditch.

Gauge.—Vertical staff driven into bed of stream near the right bank. Elevation of zero of gauge maintained at 96.47 feet since establishment.

Bench-mark.—Top of a three-quarter inch iron post located on the right bank near the gauge; assumed elevation 100.00 feet.

Channel.—Composed of gumbo.

Discharge measurements.—Made with current-meter or weir.

Observer.—J. E. Hartt.

Remarks.—This station was established September 27, 1915, by H. R. Carscallen, too late to obtain records for the irrigation season of 1915. There was no flow at each of four visits by the district engineer during 1916, and it is understood that no water was diverted during 1916.

WM. MITCHELL UPPER DITCH FROM LODGE CREEK

Location.—On the NE. ¼ Sec. 29, Tp. 5, Rge. 2, W. 4th Mer., about one mile down stream from dam and intake.

Gauge.—Vertical staff driven in the bed of the ditch near the left bank. The zero of the gauge was established and maintained at 97.05 feet.

Bench-mark.—Permanent iron bench-mark 320 feet down stream from the gauge on the left bank; assumed elevation 100.00 feet.

Channel.—Composed of gravel and gumbo.

Discharge measurements.—Made with current-meter or weir.

Artificial control.—A log control was placed in the bed of the ditch about 30 feet below the gauge.

Observer.—James Mitchell.

Remarks.—This station was established by H. R. Carscallen, July 6, 1915, too late to obtain records for the irrigation season of 1915. The ditch was used for a few days during the spring floods of 1915. There was no flow at each of four visits by the district engineer during 1916, and it is understood that no water was diverted during 1916.

WM. MITCHELL LOWER DITCH NEAR THELMA

Location.—On the SE. ¼ Sec. 15, Tp. 5, Rge. 2, W. 4th Mer., about 70 feet down stream from dam and intake on Spring creek.

Gauge.—Vertical staff driven into the bed of the ditch near the left bank. The zero of the gauge was established and maintained at 95.55 feet.

Bench-mark.—Top of iron pin set on the right bank ten feet from gauge; assumed elevation 100.00 feet.

Channel.—Composed of gumbo.

Discharged measurements.—Made with current-meter or with a weir.

Observer.—James Mitchell.

Remarks.—This station was established July 7, 1915, by H. R. Carscallen. No records were obtained during 1915. High water in the creek during February, 1916, flooded the ditch and washed out the weir, which was not replaced, the water running over the frozen ground into Lodge creek. There was no flow at each of four visits by the district engineer during the season and it is understood that no water was diverted during 1916, except the natural flooding in February.

M., M. M. AND J. M. SPANGLER DITCH FROM LODGE CREEK

Location.—On the NW. ¼ Sec. 24, Tp. 2, Rge. 30, W. 3rd Mer., two miles down stream from dam and one-half mile above reservoir No. 1.

Gauge.—Vertical staff driven into bed of ditch near the right bank. Zero of gauge maintained at 96.67 feet since establishment.

Bench-mark.—Permanent iron bench-mark situated six feet from the gauge on the right bank; assumed elevation 100.00 feet.

Channel.—Composed of gumbo.

Discharge measurements.—Made with current-meter or weir. Initial points of soundings is the bench-mark.

Observer.—None.

Remarks.—This station was established August 2, 1915, by H. R. Carscallen. No water was used during 1915 after station was established. There was no flow at each of seven visits made by the district engineer during 1916, and it is understood that no water was diverted during 1916.

D. A. HAMMOND DITCH FROM LODGE CREEK

Location.—On the NE. ¼ Sec. 5, Tp. 2, Rge. 29, W. 3rd Mer., about one-quarter mile up stream from two-way gate where ditch divides.

Gauge.—Vertical staff. The zero of the gauge was established and maintained at 98.58 feet.

Bench-mark.—Top of iron pin on the left bank of ditch fifteen feet from gauge; assumed elevation 100.00 feet.

Channel.—Composed of gumbo.

Discharge measurements.—Made by wading with current-meter or with a weir.

Observer.—D. A. Hammond.

Remarks.—This station was established August 2, 1915, by H. R. Carscallen, but no water used for irrigation after that date in 1915. There was no flow at each of eight visits by the district engineer during 1916, and it is understood that no water was diverted during 1916.

M. LYNCH DITCH FROM LODGE CREEK

Location.—On the NE. ¼ Sec. 19, Tp. 2, Rge. 29, W. 3rd Mer., about 500 feet down stream from flume over Lodge creek.

Gauge.—Vertical staff driven into bed of ditch near right bank. Zero of gauge maintained at 96.75 feet.

Bench-mark.—Top of iron pin located on the right bank six feet from the gauge; assumed elevation 100.00 feet.

Channel.—Composed of gumbo.

Discharge measurements.—Made with current-meter or weir. Initial point for soundings is the bench-mark.

Observer.—M. Lynch.

Remarks.—This station was established August 9, 1915, by H. R. Carscallen. No water has been used since station was established.

A. F. MOCK DITCH NEAR THELMA

Location.—On the NW. ¼ Sec. 21, Tp. 7, Rge. 2, W. 4th Mer., one-half mile below intake.

Gauge.—Vertical staff driven into the bed of the ditch near the left bank. The elevation of zero of gauge maintained at 97.24 feet since establishment.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—Composed of gravel and loam.

Discharge measurements.—Made with current-meter or weir.

Observer.—Adam Sturm.

Remarks.—This station was established September 29, 1915, by H. R. Carscallen. No water was used for irrigation during 1915 or 1916.

MUIR AND FRANTZEN DITCH FROM MIDDLE CREEK

Location.—On the SW. ¼ Sec. 36, Tp. 5, Rge. 2, W. 4th Mer., about 100 feet down stream from intake of branch ditch.

Records available.—No water used since station was established.

Gauge.—Vertical staff driven into bed of ditch near right bank; elevation of zero of gauge maintained at 96.86 feet since establishment.

Bench-mark.—Top of iron stake on the right bank eight feet from the gauge.

Channel.—Composed of gumbo.

Discharge measurements.—Made with current-meter or with a weir.

Observer.—James Mitchell.

Artificial control.—A control made of small rock was built 15 feet below the gauge.

Remarks.—There was no flow at each of six visits by the district engineer during 1916, and it is understood that no water has been diverted since the station was established in 1915.

LINK EAST DITCH, NORTH BRANCH, FROM DRY COULEE

Location.—On the SW. ¼ Sec. 32, Tp. 5, Rge. 1, W. 4th Mer., one hundred and ten feet from forks of ditch.

Gauge.—Vertical staff driven into the bed of the ditch near the left bank. Elevation of zero maintained at 99.07 feet since establishment.

Bench-mark.—The bench-mark for this station is the same as for the other two stations in Link's ditches and is located at the station on the south branch of the East ditch; assumed elevation 100.00 feet.

Channel.—Composed of gumbo.

Discharge measurements.—Made with a current-meter or with a weir.

Observer.—H. C. Link.

Remarks.—There was no flow at each of the six visits by the district engineer during 1916, and it is understood that no water has been diverted since the station was established in 1914.

LINK EAST DITCH, SOUTH BRANCH, FROM DRY COULEE

Location.—On the SW. ¼ Sec. 32, Tp. 5, Rge. 1, W. 4th Mer., sixty feet from forks of ditch.

Gauge.—Vertical staff driven into the bed of the ditch near the left bank. Zero of gauge maintained at 97.32 feet since establishment.

Bench-mark.—Top of a three-quarter inch iron post near the gauge on the right bank; assumed elevation 100.00 feet.

Channel.—Composed of gumbo.

Discharge measurements.—Made with a current-meter or weir.

Observer.—H. C. Link.

Remarks.—This station was established July 25, 1914. During early spring break-up an estimated flow of 20 acre-feet overflows from the coulee, flowing down across Mr. Link's irrigable land under the east ditch, while the ditches are still filled with snow. No records were obtained of this flow. There was no flow at each of six visits by the district engineer during 1916, and it is understood that no water was diverted during 1915 and 1916, except the natural overflow in the early spring.

LINK WEST DITCH FROM DRY COULEE

Location.—On the SW. ¼ Sec. 32, Tp. 5, Rge. 1, W. 4th Mer., about one hundred feet from the headgate.

Gauge.—Vertical staff driven into the bed of the ditch near the right bank. Zero of gauge maintained at 100.07 feet since establishment.

Bench-mark.—Same as for Link's East ditch, south branch; assumed elevation 100.00 feet.
Channel.—Composed of gumbo with stones.
Discharge measurements.—Made with a current-meter or weir.
Observer.—H. C. Link.
Remarks.—There was no flow at each of six visits by district engineer during 1916, and it is understood that no water has been diverted since the station was established in 1914.

MIDDLE CREEK AT ROSS' RANCH

Location.—On the SW. ¼ Sec. 30 to 5, Rge. 29, W. 3rd Mer., at Maurice Ross' ranch.
Records available.—From July 20, 1909, to October 31, 1915.
Gauge.—Vertical staff. Zero of gauge maintained at 3,291.61 during 1909-10; zero of gauge maintained at 3,290.99 during 1911; zero of gauge maintained at 3,290.98 during 1912-16.
Bench-mark.—Permanent iron bench-mark; elevation 3,297.37 feet above sea-level. (Irrigation Surveys.)
Channel.—Practically permanent.
Discharge measurements.—Made with a current-meter by wading or with a weir.
Winter flow.—Station discontinued during winter season.
Artificial control.—The flow at this station is regulated to some extent by two dams, one at W. K. Wright's ranch and the other at MacKinnon's ranch.
Diversions.—Water is diverted for irrigation above this station by W. K. Wright and Angus MacKinnon.
Observer.—Mrs. W. M. Ross.

DISCHARGE MEASUREMENTS of Middle creek at Ross' ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 28	P. A. Fetterley	29.5	57.50	1.94	2.90	112.00*m*
Mar. 30	do	27.5	37.60	1.74	2.39	65.00*m*
April 1	do	24.0	19.40	1.39	1.54	27.00 *m*
April 5	do	17.0	16.20	0.94	1.30	15.30*n*
April 7	do	16.0	11.60	0.79	1.10	9.10*n*
April 11	do	14.2	22.60	1.27	1.51	29.00
April 14	do	14.5	14.40	1.95	1.50	28.00*n*
April 25	H. W. Rowleey	7.0	2.95	0.54	0 69	1.58*n*
May 10	do	.....	.....	.....	0.64	0.66*w*
May 29	do	18.0	18.80	1.38	1.50	26.00 *m*
May 30	do	26.0	27.20	1.62	1.90	44.00 *m*
June 22	do	.....	.....	.....	0.75	0.92*w*
July 18	do	.....	.....	.....	0.73	1.01*w*
Aug. 8	do	.....	.....	.....	0.70	0.78*w*
Aug. 28	do	.....	.....	.....	0.69	0.63*w*
Sept. 22	do	.....	.....	.....	0.68	0.58*w*
Oct. 12	do	.....	.....	.....	0.68	0.63*w*
Nov. 10	do	.....	.....	.....	0.72*c*	0.52*wc*

m Discharge measured at miscellaneous sections above gauge.
n Discharge measured at miscellaneous sections below gauge.
w Discharge measured with sharp crested rectangular weir.
c Gauge height affected by backwater from ice on control.

DAILY GAUGE HEIGHT AND DISCHARGE of Middle creek at Ross' ranch, for 1916

DAY	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	1.61	30.00	0.64	0.52	2.63	87.00
2	3.07	134	1.49	25.00	0.63	0.44	1.70	34.00
3	2.89	111	1.45	23.00	0.63	0.44	1.30	16.40
4	2.25	63	1.33	17.70	0.63	0.44	0.94	4.90
5	2.15	57	1.31	16.80	0.63	0.44	0.98	5.80
6	.....	71*e*	1.25	14.40	0.63	0.44	0.94	4.90
7	.....	85*e*	1.11	9.40	0.63	0.44	0.91	4.30
8	2.89	111	1.04	7.40	0.63	0.44	1.46	23.00
9	2.83	105	0.95	5.10	0.64	0.52	1.70	34.00
10	3.05	131	0.95	5.10	0.64	0.52	1.00	6.30
11	4.02	318	1.45	23.00	0.64	0.52	0.95	5.10
12	6.41	796	1.76	37.00	0.63	0.44	2.34	68.00
13	5.70	654	1.60	30.00	0.64	0.52	3.20	155.00
14	4.25	364	1.45	23.00	0.64	0.52	2.35	69.00
15	4.04	322	1.39	20.00	0.64	0.52	1.46	23.00
16	3.39	192	0.99	6.10	0.64	0.52	1.28	15.60
17	3.09	137	1.29	16.00	0.64	0.52	0.98	5.80
18	2.65	89	1.13	10.10	0.64	0.52	0.91	4.30
19	2.78	100	0.90	4.10	0.65	0.60	0.78	2.10
20	2.79	101	0.88	3.70	0.66	0.70	0.75	1.70
21	3.78	270	0.80	2.40	0.66	0.70	0.75	1.70
22	3.89	292	0.78	2.10	0.66	0.70	0.75	1.70
23	3.77	268	0.76	1.84	0.66	0.70	0.75	1.70
24	3.35	184	0.74	1.58	0.67	0.80	0.75	1.70
25	2.20	60	0.70	1.10	0.74	1.58	0.75	1.70
26	2.17	58	0.66	0.70	1.22	13.30	0.75	1.70
27	2.31	67	0.63	0.44	0.87	3.60	0.75	1.70
28	3.04	130	0.63	0.44	0.93	4.70	0.75	1.70
29	2.37	70	0.62	0.36	2.75	98.00	1.25	14.40
30	2.41	73	0.62	0.36	1.96	47.00	0.83	2.90
31	1.77	38	.....	.....	3.14	145.00	.....	.....

e Discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of Middle creek at Ross' ranch, for 1916—*Concluded*

Day	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	0.78	2.10	0.93	4.70	0.70	1.10	0.68	0.90
2	0.81	2.60	0.78	2.10	0.70	1.10	0.68	0.90
3	0.96	5.30	0.75	1.70	0.70	1.10	0.68	0.90
4	2.54	81.00	0.73	1.46	0.70	1.10	0.68	0.90
5	3.36	186.00	0.73	1.46	0.72	1.34	0.69	1.00
6	2.80	102.00	0.72	1.34	0.73	1.46	0.69	1.00
7	....	82.00*e*	0.72	1.34	0.71	1.22	0.70	1.10
8	....	63.00*e*	0.72	1.34	0.70	1.10	0.70	1.10
9	1.90	44.00	0.75	1.70	0.70	1.10	0.69	1.00
10	1.78	38.00	1.98	48.00	0.70	1.10	0.68	0.90
11	1.00	6.30	1.50	25.00	0.70	1.10	0.68	0.90
12	0.94	4.90	1.06	8.00	0.70	1.10	0.68	0.90
13	0.77	1.98	0.98	5.80	0.70	1.10	0.68	0.90
14	0.74	1.58	0.80	2.40	0.70	1.10	0.68	0.90
15	0.73	1.46	0.74	1.58	0.70	1.10	.....*x*	.....
16	0.72	1.34	0.80	2.40	0.70	1.10	.....	.....
17	0.72	1.34	0.80	2.40	0.70	1.10	.....	.....
18	0.74	1.58	0.72	1.34	0.70	1.10	.....	.....
19	1.92	45.00	0.72	1.34	0.70	1.10	.....	.....
20	2.39	71.00	0.71	1.22	0.70	1.10	.....	.....
21	1.62	31.00	0.71	1.22	0.70	1.10	.....	.....
22	1.25	14.40	0.71	1.22	0.70	1.10	.....	.....
23	1.05	7.70	0.71	1.22	0.70	1.10	.....	.....
24	0.94	4.90	0.71	1.22	0.70	1.10	.....	.....
25	0.82	2.70	0.71	1.22	0.70	1.10	.....	.....
26	0.75	1.70	0.71	1.22	0.69	1.00	.....	.....
27	0.75	1.70	0.71	1.22	0.69	1.00	.....	.....
28	0.74	1.58	0.70	1.10	0.68	0.90	.....	.....
29	1.37	19.40	0.70	1.10	0.68	0.90	.....	.....
30	1.20	12.50	0.70	1.10	0.68	0.90	.....	.....
31	1.04	7.40	0.70	1.10	.....	.....	.....	.....

e Discharge estimated.
x Creek still running; no observations after October 14.

MONTHLY DISCHARGE of Middle creek at Ross' ranch, for 1916

(Drainage area 162 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (2-31)	796.00	38.00	182.00	1.120	1.25	10,830
April	37.00	0.36	11.30	0.070	0.08	672
May	145.00	0.44	10.50	0.065	0.07	646
June	155.00	1.70	20.00	0.012	0.01	1,190
July	186.00	1.34	27.00	0.167	0.19	1,660
August	48.00	1.10	4.20	0.026	0.03	258
September	1.46	0.90	1.10	0.007	0.01	65
October (1-14)	1.10	0.90	0.95	0.006	0.00	26
The period	.....	.....	.....	.....	1.64	15,347

MEAN MONTHLY DISCHARGE in Second-feet of Middle creek at Ross' ranch

MONTH	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	0.36	0.42	0.50	0.38	0.25	0.37	0.36	0.95*n*	0.38	23
November	.....	0.36*b*	.....	0.50*e*	0.23*g*	.....	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
March	.....	.....	.....	.....	.....	11.90*h*	121.00*k*	182.00*m*	.....	.....	.....
April	.....	0.95*c*	19.30*d*	341.00*f*	86.00*l*	41.00	62.00	11.30	.....	38.0	2,269
May	.....	0.46	3.10	5.60	0.53	0.37	0.51	10.50	.....	3.0	185
June	.....	0.39	0.70	0.81	0.30	0.42	0.60	20.00	.....	3.3	197
July	0.52*a*	0.52	3.90	0.32	0.40	0.28	2.50	27.00	.....	5.0	306
August	0.36	0.43	0.70	0.38	0.41	0.23	14.00	4.20	.....	2.6	159
September	0.36	0.43	13.30	0.44	0.28	0.26	0.37	1.10	.....	2.1	123
Total in acre-ft.	55	215	2,098	18,350	3,878	2,955	7,454	15,343	.....	.....	3,262

a 20-31.
b 1-14.
c 5-30.
d 11-30.
e 1-8.
f 5-30.
g 1-15.
h 15-31.
k 21-31.
m 2-31.
n 1-14.
l 9-30.

B. A. JAHN DITCH FROM MIDDLE CREEK

Location.—On the SE. ¼ Sec. 8, Tp. 4, Rge. 29, W. 3rd Mer., 700 feet down stream from intake of ditch.

Gauge.—Vertical staff driven into bed of ditch near right bank. Zero of gauge maintained at 95.45 feet.

Bench-mark.—Top of iron stake on left bank ten feet from gauge; assumed elevation 100.00 feet.

Channel.—Composed of gumbo.

Discharge measurements.—Made with weir or current-meter. Initial point for sounding is the bench-mark.

Observer.—B. A. Jahn.

Remarks.—There was no flow at each of the six visits by the district engineer during 1916, and it is understood that no water has been diverted since the station was established in 1915.

W. B. GREGG DITCH FROM MIDDLE CREEK

Location.—On the NE. ¼ Sec. 34, Tp. 3, Rge. 29, W. 3rd Mer., one mile down stream from intake of B. A. Jahn's ditch near two-way gate where B A. Jahn diverts water for irrigation.

Gauge.—Vertical staff driven into bed of ditch near right bank. Zero of gauge maintained at 96.20 feet since establishment.

Bench-mark.—Top of iron post on the right bank, twelve feet from gauge; assumed elevation 100.00 feet.

Channel.—Composed of gumbo.

Discharge measurements.—Made with current-meter or weir.

Observer.—B. A. Jahn.

Remarks.—There was no flow at each of six visits by the district engineer during 1916, and it is understood that no water was diverted during 1916.

E. J. PEACHEY DITCH FROM MIDDLE CREEK

Location.—On the SW. ¼ Sec. 4, Tp. 3, Rge. 29, W. 3rd Mer., one-half mile below dam and intake and in the flume along cut bank of Middle creek.

Gauge.—Vertical staff nailed to right wall of flume; zero of gauge maintained at 94.10 feet since establishment.

Bench-mark.—Top of iron post located on the right bank 150 feet down stream from gauge; assumed elevation 100.00 feet.

Channel.—Wooden flume.

Discharge measurements.—Made with current-meter or weir.

Observer.—E. J. Peachey.

Remarks.—Water was used from June 23 to July 19, but insufficient data obtained to compute discharge. There was no flow at each of four visits by the district engineer during 1916, but it is understood that water was used from June 23 to July 19. We did not, however, obtain sufficient data to estimate the quantity diverted.

DAILY GAUGE HEIGHT AND DISCHARGE of Peachey ditch from Middle creek, for 1916

JUNE			JULY			JULY		
Day	Gauge Height	Discharge	Day	Gauge Height	Discharge	Day	Gauge Height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*
23	0.48*h*	.....*x*	1	0.55	.....	11	0.50	.....
24	0.48	.....	2	0.48	.....	12	0.50	.....
25	0.48	.....	3	0.48	.....	13	0.35	.....
26	0.70	.....	4	0.55	.....	14	0.35	.....
27	0.55	.....	5	0.60	.....	15	0.35	.....
28	0.55	.....	6	0.55	.....	16	0.25	.....
29	0.55	.....	7	0.55	.....	17	0.25	.....
30	0.48	.....	8	0.48	.....	18	0.55	.....
.....	.....	.....	9	0.48	.....	19	0.70*h*	.....
.....	.....	.....	10	0.50	.....	.....	.....	.....

h Headgate open, June 23 to July 19.
x Unsufficient data collected to compute discharge, estimated average daily discharge 1.50 sec.-ft.

MIDDLE CREEK AT HAMMOND'S RANCH

Location.—On the NE. ¼ Sec. 4, Tp. 2, Rge. 29, W. 3rd Mer., at D. A. Hammond's ranch.

Records available.—Open water seasons from June 13, 1910, to October 31, 1916.

Gauge.—Vertical staff; elevation of zero of gauge maintained at 87.48 feet during 1910, and at 87.60 feet during 1911-15, and to March 24, 1916. March 25, 1916, the gauge was moved 850 feet north, 150 feet above the artificial control. Zero of gauge at new location maintained at 90.70 feet, March 25 to October 31, 1916.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Control.—An artificial control consisting of a wall of stones cemented with concrete was constructed just below the new location of gauge about the close of the 1915 season.

Discharge measurements.—Made by current-meter with cable and weights from the irrigation ditch flume just above the gauge during flood stages, by wading or with a weir during low stages.

Winter flow.—Station discontinued during winter season.

Diversions.—Water is diverted above this station by W. B. Gregg, W. S. Peachey and E. J. Jahn, for irrigation, and by the Canadian Pacific Railway Company, at Govenlock, for industrial purposes.

Observer.—Mrs. K. R. Hammond.

Accuracy.—Stage discharge relation changed slightly for low discharges during June, as the results of the artificial control being undermined and settling. Daily discharge obtained by applying mean daily gauge heights to rating table; 1915 rating table used for period, March 17 to 23.

DISCHARGE MEASUREMENTS of Middle creek at Hammond's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 25	H. W. Rowley	27	68.40	1.67	3.24	114.00
April 4	do	24	25.40	1.38	1.90	35.00 *m*
April 8	do	11	17.50	1.20	1.56	21.00 *m*
April 11	do	10	16.10	1 10	1.41	17.80 *m*
April 15	do	11	26.50	1.58	1.79	42.00 *m*
May 2	do	16	5.80	0.66	0.60	3.80 *m*
May 15	do	9	1.80	0.92	0.45	1.66 *m*
June 7	do	6	7.40	1.84	1.20	13.60 *m*
July 26	do	13	5.50	1.62	0.80	8.90 *m*
Aug. 16	do	11	5.80	0.81	0.54	4.70 *m*
Sept. 5	do	.....	.....	.....	0.18	0.93 *w*
Sept. 29	Newhall and Rowley	.....	.....	.....	0.13	0.10 *w*
Oct. 30	H. W. Rowley	.....	.....	.....	0.30	1.28 *w*

m Discharge measured 600 feet above gauge.
w Discharge measured with weir.

DAILY GAUGE HEIGHT AND DISCHARGE of Middle creek at Hammond's ranch, for 1916

DAY	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	.....	98.0*e*	0.60	3.80	2.95	95.0
2	.....	.....	.....	40.0*e*	0.60	3.80	2.75	83.0
3	.....	.....	.....	40.0*e*	0.59	3.70	1.98	39.0
4	.....	.....	1.90	35.0	0.58	3.50	1.75	28.0
5	.....	.....	1.90	35.0	0.56	3.20	1.55	21.0
6	.....	.....	1.88	34.0	0.55	3.10	1.40	17.5
7	.....	.....	1.87	33.0	0.53	2.80	1.20	13.6
8	.....	.....	1.56	21.0	0.52	2.70	1.15	12.6
9	.....	.....	1.43	18.2	0.50	2.40	1.08	11.3
10	.....	.....	1.42	17.9	0.48	2.10	1.60	23.0
11	.....	.....	1.41	17.7	0.47	1.98	1.54	21.0
12	.....	.....	1.41	15.2*s*	0.46	1.84	1.38	17.2
13	.....	.....	1.52	16.0	0.45	1.70	1.25	14.6
14	.....	.....	1.85	23.0*s*	0.45	1.70	3.00	98.0
15	.....	.....	1.78	29.0	0.44	1.58	2.25	55.0
16	.....	.....	1.62	23.0	0.44	1.58	1.90	36.0
17	5.50	210	1.57	22.0	0.44	1.58	1.68	28.0
18	4.60	133	1.40	17.5	0.43	1.46	1.40	20.0
19	4.00	91	1.44	18.4	0.43	1.46	1.32	18.5
20	4.00	91	1.40	17.5	0.42	1.34	1.25	17.1
21	5.00	165	1.28	15.2	0.41	1.22	1.05	13.3
22	.....	330*e*	1.15	12.6	0.40	1.10	0.90	10.6
23	5.50	210	1.05	10.8	0.39	0.98	0.80	8.8
24	.....	160*e*	0.97	9.5	0.39	0.98	0.70	7.2
25	3.23*x*	112	0.86	7.8	0.90	8.40	0.60	5.6
26	3.90	152	0.82	7.1	1.70	26.00	0.55	4.8
27	.....	218*e*	0.75	6.0	1.30	15.60	0.50	4.0
28	.....	218*e*	0.69	5.1	1.25	14.60	0.47	3.6
29	.....	158*e*	0.65	4.5	2.15	48.00	0.45	3.3
30	.....	158*e*	0.60	3.8	3.20	110.00	0.52	4.3
31	.....	98*e*	.....	.....	2.50	68.00	.....	.....

e Discharge estimated.
s to *s* Shifting conditions.
x Gauge moved 850 feet north, 150 feet above artificial control.

DAILY GAUGE HEIGHT AND DISCHARGE of Middle creek at Hammond's ranch, for 1916—*Concluded*

Day	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	0.50	4.0	0.72	7.50	0.01	Nil	0.09	Nil
2	0.47	3.6	0.60	5.60	0.00	"	0.08	"
3	0.55	4.8	0.52	4.30	0.08	"	0.15	0.30
4	.....	6.0e	0.44	3.20	0.20	0.70	0.16	0.38
5	0.70	7.2	0.40	2.70	0.30	1.60	0.14	0.24
6	2.90	92.0	0.35	2.10	0.24	1.02	0.16	0.38
7	2.28	56.0	0.31	1.70	0.15	0.30	0.13	0.18
8	1.90	36.0	0.29	1.50	0.10	Nil	0.11	0.06
9	1.50	23.0	0.53	4.50	0.50	4.00	0.14	0.24
10	1.30	18.1	0.50	4.00	0.36	2.20	0.26	1.20
11	1.10	14.2	0.42	2.90	0.29	1.50	0.45	3.30
12	0.90	10.6	0.35	3.10	0.25	1.10	0.39	2.60
13	0.70	7.2	1.10	14.20	0.24	1.02	0.36	2.20
14	0.58	5.3	1.15	15.10	0.22	0.86	0.34	2.00
15	0.40	2.7	0.90	10.60	0.20	0.70	0.32	1.80
16	0.35	2.1	0.52	4.30	0.18	0.54	0.32	1.80
17	1.30	18.1	0.45	3.30	0.16	0.38	0.31	1.70
18	1.30	18.1	0.40	2.70	0.15	0.30	0.31	1.70
19	1.07	13.7	0.33	1.90	0.14	0.24	0.30	1.60
20	0.70	7.2	0.30	1.60	0.12	0.12	0.29	1.50
21	2.05	44.0	0.24	1.02	0.10	Nil	0.28	1.40
22	1.50	23.0	0.20	0.70	0.10	"	0.28	1.40
23	1.40	20.0	0.18	0.54	0.10	"	0.28	1.40
24	1.20	16.1	0.16	0.38	0.10	"	0.28	1.40
25	0.95	11.5	0.14	0.24	0.10	"	0.28	1.40
26	0.80	8.8	0.12	0.12	0.10	"	0.28	1.40
27	1.69	7.0	0.10	Nil	0.12	0.12	0.29	1.50
28	1.05	13.3	0.08	"	0.11	0.06	0.29	1.50
29	0.88	10.2	0.07	"	0.11	0.06	0.29	1.50
30	1.55	24.0	0.05	"	0.10	Nil	0.30	1.60
31	0.90	10.6	0.03	"	.....	.....	0.31	1.70

e Discharge estimated.

MONTHLY DISCHARGE of Middle creek at Hammond's ranch, for 1916

(Drainage area 315 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (17-31)	330.0	91.00	167.00	0.530	0.30	4,967
April	98.0	3.80	22.00	0.070	0.08	1,309
May	110.0	0.98	11.00	0.035	0.04	676
June	98.0	3.30	24.00	0.076	0.08	1,428
July	92.0	2.10	17.40	0.055	0.06	1,070
August	15.1	Nil	3.20	0.010	0.01	197
September	4.0	"	0.56	0.002	0.00	33
October	3.3	"	1.27	0.004	0.00	78
The period	.....	.....	.....	.....	0.57	9,758

MEAN MONTHLY DISCHARGE in Second-feet of Middle creek at Hammond's ranch

MONTH	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	1.50	Nil	Nil	6.30	0.45	1.27	1.59	98
November	.....	1.00*b*	" *d*	.....	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	.....	.....	.....	.....
March	4.2*a*	.....	.....	20.00*f*	50.00	167.00*g*	.....	50.0	3,050
April	7.5	280.00*c*	155.00	56.00	76.00	22.00	.....	63.0	3,766
May	3.9	12.70	6.70	1.24	1.25	11.00	.....	6.1	377
June	2.1	2.80	1.19	Nil	2.70	24.00	.....	5.5	325
July	6.1	0.01	1.64	"	10.50	17.40	.....	5.9	366
August	Nil	Nil	Nil	"	9.70	3.20	.....	2.2	132
September	44.0	"	"	"	0.40	0.56	.....	7.5	446
Total in acre-ft.	3,954	15,515	9,807	4,167	9,464	9,708	.....	.....	8,560

a 14-31.
b 1-20.
c 5-30.
d 1-15.
f 13-31.
g 17-31.

LODGE CREEK AT WILLOW CREEK POLICE DETACHMENT

Location.—On the SE. ¼ Sec. 12, Tp. 1, Rge. 29, W. 3rd Mer., at the Willow Creek R.N.W.M.P. Detachment.

Records available.—From April 25, 1910, to October 31, 1916.

Gauge.—Vertical staff; also an inclined gauge used during spring break-up and flood stages. Zero of gauge maintained at 2,722.98 feet during 1910; zero of gauge maintained at 2,721.18 feet during 1911; zero of gauge maintained at 2,721.06 feet during 1912-16.

Bench-mark.—Permanent iron bench-mark located on the right bank at the cable support. Elevation 2,734.02 feet above mean sea-level. (International Boundary Survey.)

Channel.—Practically permanent.

Discharge measurements.—Made at station from cable car, or about 1,000 feet above, by wading or with a weir.

Winter flow.—Station discontinued during winter season.

Observer.—Corp. A. R. Price.

Accuracy.—Stage discharge relation practically permanent. Rating curve well defined between 0 and 1,550 second-feet. Gauge read to hundredths daily during normal and low stages, and twice or more during flood and fluctuating stages. Daily discharge ascertained by applying mean gauge heights to the rating table. Results good. Creek still running about four second-feet at close of season.

DISCHARGE MEASUREMENTS of Lodge creek at Willow Creek police detachment, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 27	H. W. Rowley	86	205.00	3.12	5.55	640.00
Mar. 30	do	51	89.20	3.40	4.10	302.00*m*
April 3	do	30	41.40	2.46	2.74	102.00*m*
April 8	do	30	30.40	1.74	2.25	53.00*m*
April 10	do	28	34.60	1.38	2.20	48.00*m*
April 14	do	33	40.40	2.42	2.67	98.00*m*
May 1	do	29	15.40	0.88	1.74	13.60*m*
May 13	do	21	12.40	0.52	1.63	6.40*m*
June 3	do	37	50.20	3.01	3.40	151.00*m*
June 6	do	31	30.60	1.80	2.26	55.00*m*
June 30	do	51	93.20	2.70	4.00	252.00
July 4	do	106	472.00	3.24	8.00	1,527.00
July 4	do	105	454.00	3.18	7.85	1,444.00
July 5	do	88	239.00	2.88	5.65	688.00
July 22	do	31	33.00	2.00	2.48	66.00*m*
July 26	do	21	13.20	1.89	1.92	25.00*m*
Aug. 15	do	27	17.00	1.10	1.85	18.70*m*
Sept. 2	do	.....	.....	.....	1.35	0.58*mw*
Sept. 9	do	28	21.20	1.41	2.04	31.00*m*
Sept. 29	Newhall and Rowley	.....	.....	.....	1.30	0.34*mw*
Oct. 30	H. W. Rowley	21	7.70	0.49	1.53	3.80*m*

m Discharge measured at miscellaneous section, above gauge.
w Measurement made with sharp-crossed rectangular weir.

DAILY GAUGE HEIGHT AND DISCHARGE of Lodge creek at Willow Creek police detachment, for 1916

Day	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Fei	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Se*
1	.....	.....	3.15	144.0	1.75	14.5	4.71	425.0
2	.....	.....	2.90	113.0	1.74	14.0	4.05	284.0
3	.....	.....	2.85	108.0	1.72	13.0	3.21	151.0
4	.....	.....	2.75	96.0	1.75	14.5	2.85	108.0
5	.....	.....	2.65	86.0	1.72	13.0	2.45	66.0
6	.....	.....	2.50	71.0	1.70	12.0	2.32	54.0
7	.....	.....	2.45	66.0	1.65	10.0	2.20	44.0
8	.....	.....	2.28	50.0	1.63	9.2	2.43	64.0
9	.....	.....	2.20	44.0	1.62	8.8	2.55	76.0
10	.....	.....	2.24	47.0	1.65	10.0	2.35	56.0
11	.....	.....	2.26	49.0	1.63	9.2	2.17	42.0
12	9.10	1,990	2.45	66.0	1.65	10.0	4.24	321.0
13	9.20	2,033	2.50	71.0	1.63	9.2	6.22	855.0
14	8.90	1,904	2.66	87.0	1.60	8.0	4.15	303.0
15	6.20	848	2.58	79.0	1.65	10.0	3.53	196.0
16	4.95	485	2.42	63.0	1.63	9.2	3.02	127.0
17	4.85	460	2.42	63.0	1.60	8.0	2.70	91.0
18	4.35	344	2.35	56.0	1.59	7.7	2.45	66.0
19	4.30	333	2.20	44.0	1.57	7.0	2.25	48.0
20	4.30	333	2.15	40.0	1.55	6.3	2.15	40.0
21	6.10	816	2.12	38.0	1.54	6.0	2.10	36.0
22	7.00	1,121	2.02	30.0	1.54	6.0	2.03	31.0
23	7.05	1,140	1.94	25.0	1.54	6.0	2.00	29.0
24	5.75	708	1.90	23.0	1.57	7.0	1.95	26.0
25	4.80	447	1.90	23.0	1.90	23.0	1.90	23.0
26	4.75	435	1.84	19.4	2.05	32.0	1.85	20.0
27	6.75	1,032	1.82	18.2	2.40	61.0	1.80	17.0
28	5.10	525	1.77	15.5	2.25	48.0	1.85	20.0
29	4.40	354	1.74	14.0	2.40	61.0	1.83	18.8
30	4.15	303	1.73	13.5	3.65	214.0	3.45	184.0
31	3.60	206	.....	.....	4.76	437.0	.....	.....

DAILY GAUGE HEIGHT AND DISCHARGE of Lodge creek at Willow Creek police detachment —*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.73	94.0	2.25	48.0	1.35	0.58	1.25	0.20
2	2.05	32.0	1.95	26.0	1.35	0.58	1.25	0.20
3	2.10	36.0	1.90	23.0	1.35	0.58	1.40	2.00
4	7.16	1,181.0	1.87	21.0	1.43	2.80	1.40	2.00
5	5.85	738.0	1.80	17.0	1.45	3.30	1.40	2.00
6	3.75	230.0	1.75	14.5	2.35	56.00	1.35	0.58
7	3.55	198.0	1.73	13.5	2.00	29.00	1.35	0.58
8	2.98	123.0	1.65	10.0	1.85	20.00	1.50	4.60
9	2.75	96.0	1.68	11.2	2.00	29.00	1.65	10.00
10	2.65	86.0	1.70	12.0	1.95	26.00	1.35	0.58
11	2.25	48.0	1.70	12.0	1.84	19.40	1.90	23.00
12	2.10	36.0	1.65	10.0	1.75	14.50	1.80	17.00
13	1.95	26.0	1.65	10.0	1.70	12.00	1.80	17.00
14	1.85	20.0	1.80	17.0	1.65	10.00	1.75	14.50
15	1.75	14.5	1.85	20.0	1.63	9.20	1.73	13.50
16	1.74	14.0	1.80	17.0	1.55	6.30	1.68	11.20
17	1.73	13.5	1.76	15.0	1.53	5.60	1.64	9.60
18	1.98	28.0	1.75	14.5	1.50	4.60	1.60	8.00
19	2.60	81.0	1.72	13.0	1.45	3.30	1.58	7.30
20	3.00	125.0	1.63	9.2	1.43	2.80	1.56	6.60
21	2.70	91.0	1.58	7.3	1.43	2.80	1.50	4.60
22	2.35	56.0	1.53	5.6	1.38	1.43	1.58	7.30
23	2.53	74.0	1.53	5.6	1.35	0.58	1.56	6.60
24	2.23	46.0	1.50	4.6	1.35	0.58	1.55	6.30
25	2.05	32.0	1.50	4.6	1.33	0.48	1.55	6.30
26	1.94	25.0	1.48	4.1	1.32	0.44	1.55	6.30
27	1.88	22.0	1.55	6.3	1.31	0.39	1.54	6.00
28	3.65	214.0	1.50	4.6	1.31	0.39	1.54	6.00
29	2.70	91.0	1.50	4.6	1.30	0.34	1.54	6.00
30	3.54	197.0	1.45	3.3	1.28	0.28	1.54	6.00
31	2.65	86.0	1.40	2.0	.....	.....	1.54	6.00

MONTHLY DISCHARGE of Lodge creek at Willow Creek police detachment, for 1916

(Drainage area 823 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (12-31)	2,033	206.00	791.0	0.961	0.71	31,371
April	144	13.50	55.0	0.067	0.07	3,273
May	437	6.00	36.0	0.044	0.05	2,214
June	855	17.00	127.0	0.154	0.17	7,557
July	1,181	13.50	134.0	0.163	0.19	8,239
August	48	2.00	12.5	0.015	0.02	769
September	56	0.28	8.8	0.011	0.01	524
October	23	0.20	7.0	0.009	0.01	430
The period					1.23	54,377

Mean Monthly Discharge of Lodge creek at Willow Creek police detachment

Area of watershed 824 square miles
Average run-off per square mile 53.2 acre-feet

Year	Mar. Sec.-ft.	April Sec.-ft.	May Sec.-ft.	June Sec.-ft.	July Sec.-ft.	Aug. Sec.-ft.	Sept. Sec.-ft.	Oct. Sec.-ft.	Nov. Sec.-ft.	Total Acre-ft.	Remarks
1910.....	.....	*6a*	*1.41a*	00	00	00.0	00	00.0	00.0	*115a*	Note.—High discharges for 1911 and 1912 computed from two slope measurements. *a* Records incomplete; omitted from averages. *b* Reduced to monthly average.
1911.....	*141a*	106	16	16	28	00.0	168	2.0	*1.3a*	24,308	
1912.....	00	1,242*b*	26	16	00	00.0	00	00.0	00.0	66,701	
1913.....	.....	465	24	2	2	00.2	00	00.0	...	29,492	
1914.....	58*b*	123	6	0	0	00.0	0	18.0	....	12,374	
1915.....	110*b*	260	9	14	.67	25.0	1.47	00.3	. .	29,384	
1916.....	791*b*	55	36	127	134	12.0	9	07.0	.. ..	54,377	
Average Sec.-ft. ..	240	375	19	25	33	5.0	26	4.0	00.0	36,106	
Average Acre-ft. .	14,757	22,314	1,168	1,488	2,029	307	1,547	246	00	43,856	

Miscellaneous Discharge Measurements made in Lodge creek drainage basin, in 1916

Date	Engineer	Stream	Location	Width	Area of Section	Mean Velocity	Discharge
				Feet	*Sq. ft.*	*Ft. per sec.*	*Sec.-ft.*
May 26..	H. W. Rowley	Bare creek..	SW. 25-3-1-4....	6	5.40	0.50	2.70
July 14..	do	do ...	do	.....	.....	.....	Nil
Aug. 7..	do	do ...	do	.....	.....	.....	"
Aug. 26..	do	do ...	do	.....	.....	.....	"
Oct. 31..	do	do ...	do	.....	.....	.....	"
May 9..	do	Middle creek	SW. 35-5-1-4....	.....	.....	.....	1 44*w*
May 23..	do	do ...	do	.....	.....	.....	2.00*w*
June 19..	do	do ...	do	14	6.60	0.58	3.80
July 14..	do	do ...	do	.....	.....	.....	2.10*w*
Aug. 4..	do	do ...	do	.....	.....	.....	2.20*w*
Aug. 24..	do	do ...	do	.....	.....	.....	0.96*w*
Sept. 20..	do	do ...	do	.....	.....	.....	1.00*w*
Oct. 9..	do	do ...	do	8	3.20	0.39	1.24
Nov. 8..	do	do ...	do	.....	.....	.....	1.62*w*
May 22..	do	Lodge creek	NW. 10-6-3-4....	10	3.20	0.62	2.00
July 12..	do	do	SW. 15-6-3-4....	11	4.60	0.91	4.20
Aug. 23..	do	do ...	do	.....	.....	.....	0.98*w*
Nov. 7..	do	do ...	do	12	3.80	0.60	2.30
May 26..	do	do ...	NE. 25-3-1-4....	16	22.40	0.98	22.00
July 15..	do	do ...	do	10	4.80	1.06	5.10
Aug. 7..	do	do ...	do	9	3.70	1.27	3.80
Aug. 26..	do	do ...	do	.....	.....	.....	1 34*w*
Oct. 31..	do	do ...	do	7	2.70	1.78	4.80
May 18..	do	Sexton creek..	SW. 21-7-3-4....	.....	.....	.....	0 50*w*
June 16..	do	do ...	do	.....	.....	.....	1.66*w*
July 11..	do	do ...	do	.....	.....	.....	0.41*w*
Aug. 2..	do	do ...	do	.....	.....	.....	0.17*w*
Aug. 22..	do	do ...	do	.....	.....	.....	0.22*w*
Sept. 16..	do	do ...	do	.....	.....	.....	0.26*w*

w Discharge determined by using a weir.

BATTLE CREEK DRAINAGE BASIN

General Description

Battle creek rises in Township 8, Range 2, West of the 4th Meridian, and flows in an easterly direction for about eight miles, where it crosses the 4th Meridian, then turns in a southeasterly direction and crosses the international boundary in Section 3, Township 1, Range 26, West of the 3rd Meridian, eventually emptying into Milk river near Chinook, Montana.

As is characteristic of the streams in this locality, the valley is narrow and deep near the source and gradually broadens out into large flats and meadows. These large flats are first noticed in the vicinity of Battle Creek post office. Near the head of the stream the valley is well wooded with fair sized timber, but this diminishes to a growth of willow brush along the banks and finally disappears altogether.

The chief tributaries of Battle creek are Tenmile creek joining it in Section 4, Township 6, Range 29, West of the 3rd Meridian, and Sixmile coulee, joining it in Section 21, Township 6, Range 29, West of the 3rd Meridian. Stations have been established on both of these streams, but only the one on Sixmile coulee was maintained during 1916.

Three stations were maintained on Battle creek during 1916 at the following places: Tenmile Police Detachment, Wilkes' ranch and Nash's ranch. Late in the fall a new station equipped with an automatic gauge, was established near the international boundary. It was constructed and will be maintained jointly by the United States Geological Survey and this department.

Although it will be several years before it reaches its fullest development, works for the irrigation of the flats along the creeks are increasing each year. This, it is expected, will result in a more uniform flow in the creek, as a certain amount of the water diverted by the irrigation ditches will be returned to the creek through seepage.

B. CHEESEMAN WEST DITCH FROM SIXMILE CREEK

Location.—On the SE. ¼ Sec. 12, Tp. 8, Rge. 29, W. 3rd Mer., at Ben Cheeseman's ranch buildings.

Records available.—No gauge height observations obtained as no appreciable quantity of water used since establishment of the station on June 20, 1914.

Gauge.—Vertical staff; zero elevation of gauge maintained at 94.36 feet.

Bench-mark.—Permanent iron bench-mark on the right bank established August 11, 1916. Assumed elevation 100.00 feet. Relative elevation of former wooden stake bench-mark 99.73 feet.

Discharge measurement.—Made with permanent twenty-four-inch weir, located eight feet below gauge; elevation of crest maintained at 96.11 feet.

Remarks.—Six visits were made to this station during 1916, but there was no discharge at each visit, and it is understood that very little water was diverted during 1916.

B. CHEESEMAN EAST DITCH FROM SIXMILE CREEK

Location.—On the SE. ¼ Sec. 12, Tp. 8, Rge. 29, W. 3rd Mer., 125 feet below dam.

Records available.—No water used since station was established on June 20, 1914.

Gauge.—Vertical staff; zero of gauge maintained at 94.78 since establishment.

Bench-mark.—Top of wooden stake on the left bank, opposite gauge; assumed elevation 100.00 feet.

Discharge measurements.—Made from permanent, rectangular, sharp-crested 24-inch weir, ten feet below gauge.

Remarks.—This station was visited six times during 1916, but there was no flow at each visit, and it is understood that no water was diverted during 1916.

SPANGLER DITCH FROM SIXMILE COULEE

Location.—On the SW. ¼ Sec. 6, Tp. 7, Rge. 28, W. 3rd Mer., at Spangler's ranch.

Records available.—For the irrigation seasons of 1912-16.

Gauge.—Vertical staff. Zero of gauge has been maintained at 96.57 feet since establishment.

Bench-mark.—The top of the I. P. stake; assumed elevation 100.00 feet.

Channel.—Composed of soft clay.

Discharge measurements.—Made by a current-meter or with a weir.

Observer.—J. M. Spangler.

Remarks.—Six visits were made during 1916, but there was no flow at time of each visit, and it is understood that no water was used during 1916.

SIXMILE COULEE AT SPANGLER'S RANCH

Location.—On the SW. ¼ of Sec. 6, Tp. 7, Rge. 28, W. 3rd Mer., near Mr. Spangler's house. The present station is 850 feet north of the first station established July 4, 1911.

Records available.—At first station from July 30, 1911, to November 7, 1911; at present station April 13, 1912, to November 1916.

Gauge.—Vertical staff; zero of gauge maintained at 90.68 feet (original station) during 1911; zero of gauge maintained at 96.73 feet during 1912-16. Gauge read by D. B. Spangler.

Bench-mark.—Permanent iron bench-mark located on the left bank, 850 feet below the gauge.

Channel.—Practically permanent.

Discharge measurements.—Made by wading or with weir.

Artificial control.—Permanent six-foot weir installed 175 feet below gauge. September 8, 1915; elevation of crest 98.99 feet.

Winter flow.—Station discontinued during winter season.

Diversions.—Water is diverted by J. M. Spangler for irrigation one-half mile up stream.

Accuracy.—Stage discharge relation practically permanent after April 20. Before this date slightly shifting owing to ice and escape of water underneath the artificial control. Gauge is read to hundredths at least once daily. Rating curve fairly well defined for all stages up to 100 second-feet. Results good. Daily discharge obtained by applying mean daily gauge heights to rating table.

DISCHARGE MEASUREMENTS of Sixmile coulee at Spangler's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 27	P. A. Fetterley	11.0	28.50	0.75	3.62	21.00*n*
April 1	do	8.5	21.00	0.49	2.97	10.20*n*
April 8	do	5.4	4.28	1.76	2.81	7.50*n*
April 15	do	5.5	4.63	1.71	2.72	7.90*n*
April 20	H. W. Rowley	5.5	3.83	2.04	2.63	7.80*n*
May 12	do	.....	.....	.....	2.70	7.00*w*
May 31	do	17.0	54.80	1.61	5.09	88.00*m*
June 24	do	7.5	17.50	1.37	3.59	24.00*n*
June 26	do	8.0	15.40	1.25	3.32	19.20*n*
July 20	do	.....	.....	.....	2.66	5.80*w*
Aug. 11	do	.....	.....	.....	2.77	7.80*w*
Aug. 30	do	.....	.....	.....	2.51	2.90*w*
Sept. 26	V. A. Newhall and H. W. Rowley	.....	.....	.....	2.48	2.50*w*
Nov. 13	H. W. Rowley	.....	.....	.....	2.40*c*	1.27*w*

m Measurement made at miscellaneous sections above gauge.
n Measurement made at miscellaneous sections below gauge.
c Gauge height affected by backwater from ice on control.
w Weir measurement

DAILY GAUGE HEIGHT AND DISCHARGE of Sixmile coulee at Spangler's ranch, for 1916

DAY	February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1				13.00*e*	3.03	13.2	2.73	7.5	4.76	74.0
2			3.20	12.60	2.98	12.0	2.75	7.8	4.38	53.0
3			2.96	8.00	2.81	8.6	2.71	7.1	4.15	42.0
4			2.76	4.20	2.84	9.0	2.73	7.5	3.94	34.0
5			2.68	2.70	2.83	8.4	2.70	6.9	3.94	34.0
6			2.69	2.90	2.81	7.8	2.68	6.5	4.28	48.0
7			2.71	3.30	2.74	5.3	2.67	6.3	4.24	46.0
8			2.58	0.82	2.66	4.6	2.67	6.3	4.01	36.0
9			2.87	6.30	2.76	6.9	2.66	6.1	3.75	28.0
10			4.89	69.00	2.76	7.1	2.67	6.3	3.68	26.0
11			5.76	122.00	2.75	7.3	2.67	6.3	4.14	42.0
12			5.33	96.00	2.73	7.3	2.68	5.0	5.23	102.0
13			4.96	74.00	2.67	6.3	2.59	4.8	4.73	72.0
14			4.55	52.00	2.74	8.0	2.59	4.8	4.33	50.0
15			4.35	42.00	2.67	7.1	2.62	5.4	4.03	37.0
16	6.51	167.0*s*	4.45	46.00	2.65	6.9	2.63	5.6	3.91	33.0
17	6.38	159.0	4.36	42.00	2.64	7.1	2.64	5.8	3.75	28.0
18	6.21	149.0	4.17	35.00	2.68	8.0	2.64	5.8	3.61	25.0
19	6.05	139.0	4.06	31.00	2.64	7.5*s*	2.62	5.4	3.47	22.0
20	5.89	129.0	4.27	39.00	2.75	7.8	2.59	4.8	3.32	18.9
21	5.67	116.0	4.23	37.00	2.74	7.7	2.59	4.8	3.21	16.7
22	5.27	92.0	3.90	27.00	2.71	7.1	2.58	4.6	3.22	16.9
23	4.93	72.0	3.69	22.00	2.70	6.9	2.64	5.8	3.57	24.0
24	4.71	60.0	3.22	13.00	2.68	6.5	2.69	6.7	3.58	24.0
25	4.47	48.0	3.22	13.00	2.68	6.5	2.72	7.3	3.47	22.0
26	4.29	40.0	3.17	12.00	2.65	6.0	2.77	8.2	3.32	18.9
27	3.99	29.0	3.65	22.00	2.65	6.0	4.04	38.0	3.24	17.3
28	3.47	17.9	3.41	17.50	2.65	6.0	4.23	46.0	3.12	14.9
29	3.26	13.7	3.19	13.90	2.66	6.1	4.29	48.0	3.10	14.5
30			3.09	12.80	2.67	6.3	4.99	87.0	3.26	17.7
31			3.03	12.40			5.16	98.0		

s-s Shifting conditions.
e Discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of Sixmile coulee at Spangler's ranch, for 1916—*Concluded*

DAY	July		August		September		October		November	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.17	15.9	2.63	5.6	2.47	2.5	2.54	3.9	2.58	4.60
2	3.10	14.5	2.61	5.2	2.46	2.3	2.56	4.2	2.60	5.00
3	3.14	15.3	2.57	4.4	2.45	2.2	2.60	5.0	2.62	5.40
4	3.24	17.3	2.55	4.0	2.55	4.0	2.62	5.4	2.64	5.80
5	3.13	15.1	2.56	4.2	2.55	4.0	2.65	6.0	2.64	5.80
6	3.03	13.2	2.55	4.0	2.55	4.0	2.58	4.6	2.60	5.00
7	2.98	12.2	2.54	3.9	2.55	4.0	2.64	5.8	2.58	4.60
8	3.10	14.5	2.53	3.7	2.54	3.9	2.58	4.6	2.55	4.00
9	3.40	20.0	2.61	5.2	2.54	3.9	2.95	11.6	2.53	3.70
10	3.08	14.1	2.95	11.6	2.53	3.7	2.94	11.5	2.42	1.58
11	2.92	11.1	2.75	7.8	2.53	3.7	2.90	10.7	2.39	1.01*x*
12	2.81	9.0	2.85	9.8	2.51	3.3	2.86	9.9	.....	.....
13	2.75	7.8	2.84	9.6	2.53	3.7	2.80	8.8	.....	.....
14	2.70	6.9	2.77	8.2	2.54	3.9	2.79	8.6	.....	.....
15	2.65	6.0	2.74	7.7	2.54	3.9	2.76	8.0	.....	.....
16	2.64	5.8	2.72	7.3	2.53	3.7	2.74	7.7	.....	.....
17	2.65	6.0	2.68	6.5	2.53	3.7	2.70	6.9	.....	.....
18	2.72	7.3	2.75	7.8	2.51	3.3	2.66	6.1	.....	.....
19	2.63	5.6	2.67	6.3	2.50	3.1	2.62	5.4	.....	.....
20	2.64	5.8	2.63	5.6	2.50	3.1	2.59	4.8	.....	.....
21	2.63	5.6	2.60	5.0	2.49	2.9	2.65	6.0	.....	.....
22	2.62	5.4	2.57	4.4	2.49	2.9	2.69	6.7	.....	.....
23	2.60	5.0	2.55	4.0	2.48	2.7	2.69	6.7	.....	.....
24	2.57	4.4	2.54	3.9	2.48	2.7	2.68	6.5	.....	.....
25	2.53	3.7	2.55	4.0	2.48	2.7	2.68	6.5	.....	.....
26	2.80	8.8	2.55	4.0	2.48	2.7	2.67	6.3	.....	.....
27	2.75	7.8	2.55	4.0	2.46	2.3	2.67	6.3	.....	.....
28	2.74	7.7	2.52	3.5	2.54	3.9	2.65	6.0	.....	.....
29	2.67	6.3	2.51	3.3	2.55	4.0	2.60	5.0	.....	.....
30	2.66	6.1	2.51	3.3	2.54	3.9	2.60	5.0	.....	.....
31	2.65	6.0	2.49	2.9	.....	.....	2.60	5.0	.....	.....

x Records discontinued; creek still running about 1 second-feet.

MONTHLY DISCHARGE of Sixmile coulee at Spangler's ranch, for 1916

(Drainage area 42 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
February (16-29)	167.0	13.70	88.0	2.100	1.09	2,443
March	122.0	0.82	29.0	0.690	0.80	1,783
April	13.2	4.60	7.4	0.176	0.20	440
May	98.0	4.60	15.4	0.367	0.42	947
June	102.0	14.50	35.0	0.833	0.93	2,083
July	20.0	3.70	9.4	0.224	0.26	578
August	11.6	2.90	5.5	0.131	0.15	338
September	4.0	2.20	3.4	0.081	0.09	202
October	11.6	3.90	6.6	0.157	0.18	406
November (1-11)	5.8	1.01	4.2	0.100	0.04	92
The period	.....	.....	.....	.....	4.16	9,312

WOOD AND ANDERSON DITCH NEAR COULEE

Location.—On the NE. ¼ Sec. 21, Tp. 7, Rge. 29, W. 3rd Mer., about 150 miles West of ranch house.

Records available.—For the irrigation season of 1915 and 1916.

Gauge.—Vertical staff; zero of gauge maintained at 95.67 feet during 1916. Zero elevation maintained at 94.62 feet during 1915.

Bench-mark.—Permanent iron bench-mark on right bank established 1916; assumed elevation 100.00 feet. Relative elevation of former wooden stake bench-mark 97.82 feet.

Artificial control.—A permanent twenty-four-inch, sharp-crested, rectangular weir, located ten feet below the gauge, controls the flow at this station; elevation of crest maintained at 96.67 feet during 1916.

Discharge measurements.—Made with weir.

Observer.—D. Wood.

Remarks.—Six visits were made during 1916, but there was no flow at time of each visit, and it is understood that no water was diverted during 1916.

WOOD AND ANDERSON NORTH DITCH FROM WHITE MUD COULEE

(Reported as West ditch near Coulee in 1915)

Location.—On the NE. ¼ Sec. 22, Tp. 7, Rge. 29, W. 3rd Mer., three hundred and seventy-five feet below intake of ditch.

Records available.—No water was used during irrigation seasons of 1914, 1915 and 1916.

Gauge.—Vertical staff; elevation of zero maintained at 97.36 feet since establishment of station.

Bench-mark.—Permanent iron bench-mark established in 1916 on the left bank; assumed elevation 100.00 feet. Relative elevation o former wooden stake bench-mark 99.82 feet.

Artificial control.—A twenty-four inch, sharp-crested weir controls the flow at this station and is located ten feet below the gauge; the elevation of the crest was maintained at 98.17 feet during 1916.

Discharge measurements.—Made with weir.

Observer.—D. Wood.

Remarks.—Six visits were made during the season, but there was no flow at time of each visit.

WOOD AND ANDERSON SOUTH DITCH FROM WHITE MUD COULEE

(Reported as East Ditch near Coulee in 1915)

Location.—On the SE. ¼ Sec. 22, Tp. 7, Rge. 29, W. 3rd Mer.

Records available.—For the irrigation season of 1915 and 1916.

Gauge.—Vertical staff; zero elevation of gauge maintained at 96.83 feet since establishment.

Bench-mark.—Permanent iron bench-mark on the right bank; assumed elevation 100.00 feet. Relative elevation of wooden stake B.M. reported in 1915 99.67 feet.

Channel.—Composed of clay and gravel.

Discharge measurements.—Made by measuring head over thirty-six-inch, sharp-crested, rectangular weir which is permanently located ten feet below the gauge.

Artificial control.—Thirty-six-inch, sharp-crested, rectangular weir, located ten feet below gauge. Elevation of crest of weir maintained during 1916 at 98.76 feet.

Observer.—D. Wood.

Remarks.—Six visits were made during 1916, but there was no flow at time of each visit.

F. L. MULL WEST DITCH NEAR COULEE

Location.—On the NW. ¼ Sec. 24, Tp. 7, Rge. 29, W. 3rd Mer., about 900 feet below dam and intake.

Records available.—During the irrigation seasons of 1915-1916.

Gauge.—Vertical staff driven into the bed of ditch near left bank. Elevation of zero of gauge maintained at 96.02 since establishment.

Bench-mark.—Top of iron post located on the right bank near gauge; assumed elevation 100.00 feet.

Channel.—Composed of sand and gravel.

Discharge measurements.—Made by measuring the head over permanent sharp-crested weir, located ten feet below gauge; elevation of crest of weir maintained at 96.90 feet.

Observer.—Fred Mull.

Remarks.—Six visits were made to this station during 1916, but there was no flow at time of each visit, and it is understood that no water was diverted during 1916.

F. L. MULL EAST DITCH NEAR COULEE

Location.—On the NW. ¼ Sec. 24, Tp. 7, Rge. 29, W. 3rd Mer., about 800 feet below dam and intake of irrigation ditch.

Records available.—For the irrigation seasons of 1915 and 1916, during which no water was used.

Gauge.—Vertical staff. Zero of gauge maintained at 98.53 feet since establishment.

Bench-mark.—Top of iron post on the right bank near gauge and ten feet up stream from permanent weir.

Channel.—Composed of sand and gravel.

Discharge measurements.—Made by measuring the head on permanent twenty-four-inch weir, located ten feet below gauge.

Observer.—Fred Mull.

Remarks.—Six visits were made to this station during 1916, but there was no flow at time of each visit, and it is understood that no water was diverted during 1916.

J. E. PARSONAGE DITCH NEAR BATTLE CREEK

Location.—On the SW. ¼ Sec. 3, Tp. 7, Rge. 29, W. 3rd Mer., about 70 feet up stream from bridge on road allowance between Tps. 6 and 7, Rge. 29.

Gauge.—Vertical staff driven into bed of ditch about ten feet up stream from permanent weir. Zero of gauge maintained at 95.86 feet.

Bench-mark.—Top of three-quarter-inch iron post, on right bank, 15 feet from gauge; assumed elevation 100.00 feet.

Channel.—Composed of sand and gravel.

Discharge measurements.—Made by measuring the head over crest of permanent sharp-crested, twenty-four-inch, rectangular weir. Elevation of crest of weir maintained at 96.96 feet.

Observer.—J. E. Parsonage.

Remarks.—Six visits were made during 1916, but there was no flow at time of each visit, and it is understood that no water was used during 1916.

LINDNER DITCH FROM BATTLE CREEK

Location.—On the NW. ¼ Sec. 10, Tp. 6, Rge. 29, W. 3rd Mer., near Tenmile Police Detachment.

Records available.—For the irrigation seasons of 1910-1916.

Gauge.—Vertical staff. Zero elevation of gauge maintained at 95.84 feet during 1915; zero elevation of gauge maintained at 90.36 feet during 1916.

Bench-mark.—A permanent iron bench-mark, located near intake headgate; assumed elevation 100.00 feet.

Channel.—Composed of gravel and clay loam.

Discharge measurements.—Made with a forty-three-inch weir which is permanently installed in the ditch.

Observer.—J. B. Lindner.

Remarks.—This is a weir station consisting of a forty-two-inch, sharp-crested weir, with complete end contractions. The elevation of the crest of the weir was kept at a gauge height of 1.04 feet during 1914-16. Nine visits were made during 1916, but there was no flow at the time of each visit.

Daily Gauge Height and Discharge of Lindner ditch from Battle creek, for 1916

April			May			July		
Day	Gauge Height	Discharge	Day	Gauge Height	Discharge	Day	Gauge Height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*
17	1.61*h*	4.80	6	1.96*h*	9.7	14	1.36*h*	2.1
18	1.61	4.80	7	1.96	9.7	15	1.46	3.1
19	1.61	4.80	8	1.96	9.7	16	1.46	3.1
20	1.61	4.80	9	1.96*h*	9.7	17	1.46	3.1
21	1.61	4.80	.....	.....	.....	18	1.46*h*	3.1
22	1.61	4.80	.....	.....	.....	.....	.....	.....
23	1.61	4.80	.....	.....	.....	.....	.....	.....
24	1.61	4.80	.....	.....	.....	.....	.....	.....
25	1.06*h*	0.03	.....	.....	.....	.....	.....	.....

h Headgate open from April 17 to April 25, May 6 to May 9, and July 14 to July 18.

MONTHLY DISCHARGE of Lindner ditch from Battle creek, for 1916

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
April (17-25)	4.8	0.03	4.3			77
May (6-9)	9.7	9.70	9.7			77
June						
July (14-18)	3.1	2.10	2.9			29
The period						183

BATTLE CREEK AT TENMILE POLICE DETACHMENT

Location.—On the NE. ¼ Sec. 33, Tp. 5, Rge. 29, W. 3rd Mer., at the highway bridge, about one-quarter mile south of Tenmile R.N.W.M.P. Detachment, and 300 yards north of the new Battle Creek post office.

Records available.—Open water flow from June 3, 1909, to October 31, 1916.

Gauge.—Chain gauge fastened to the guard rail, on the downstream side of bridge. Zero of gauge maintained at 86.97 feet. Length of chain (from marker to bottom of weight) 19.10 feet, during 1909-10. Zero of gauge maintained at 86.87 feet. Length of chain 19.10 feet during 1911. Zero of gauge maintained at 86.84 feet. Length of chain 19.11 feet during 1912-16.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—Practically permanent, but might shift during extreme floods. Weeds in the channel affect the gauge heights at times, during mid-summer season.

Discharge measurements.—Made from downstream side of bridge during high water and by wading or with weir some distance below during low-water flow.

Winter flow.—Station discontinued during winter season.

Diversions.—Lindner Brothers divert water for irrigation about two miles above. There are several large beaver dams above this station which have a tendency to keep the creek running at this point after the creek goes dry farther up towards its source in the Cypress hills.

Observers.—Tom Bell, March 10 to June 1; Hugh Thomas, June 2 to October 31.

Accuracy.—Stage—discharge relation slightly shifting during period July 18 to October 31, caused by growth of vegetation in stream control.

Rating curve well defined between 50 and 1,000 second-feet. Gauge read to hundredths once daily during normal stages, twice daily during high fluctuating stages. Daily discharge ascertained by applying mean daily gauge heights to rating table from March 10 to July 17; by Bolster method July 18 to October 31.

Remarks.—At gauge height 11.24 feet. Battle creek overflowed its banks about 1,000 feet up stream, and a small quantity of water drained off into Middle creek.

DISCHARGE MEASUREMENTS of Battle creek at Tenmile police detachment, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 23	P. A. Fetterly	43	69.7	2.00	4.57	139*n*
Mar. 27	do	45	66.0	2.00	4.42	132*n*
Mar. 31	do	42	46.0	1.60	3.68	74*n*
April 4	do	38	39.7	1.34	3.41	53*n*
April 7	do	41	46.1	1.36	3.50	63*n*
April 11	do	40	47.7	1.77	3.83	85*n*
April 14	do	41	43.9	1.74	3.73	77*n*
April 25	do	39	33.4	1.50	3.21	50*n*
May 11	H. W. Rowley	38	35.6	1.40	3.30	50*n*
May 28	do	43	183.0	1.63	6.16	298
May 29	do	46	221.0	1.76	6.94	388
May 30	do	66	347.0	2.04	9.19	707
May 31	do	72	477.0	2.03	11.14	967
June 23	do	44	71.9	2.20	4.78	158*n*
June 26	do	43	56.3	1.85	4.06	104*n*
July 18	do	39	37.8	1.38	3.42	52*n*
Aug. 9	do	38	36.8	1.45	3.56	53*n*
Aug. 29	do	37	29.3	1.36	3.41	40*n*
Sept. 23	do	37	29.5	1.19	3.36	35*n*
Oct. 10	do	39	38.7	1.49	3.69	58*n*
Nov. 12	do	36	39.6	0.63	3.30	23*in*

i Ice conditions at gauge.
n Discharge measured at miscellaneous section below the gauge.

DAILY GAUGE HEIGHT AND DISCHARGE of Battle creek at Tenmile police detachment, for 1916

Day	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			3.60	70	3.23	48	7.08	406
2			3.61	71	3.44	60	6.00	280
3			4.00	98	3.37	56	5.40	216
4			3.78	83	3.30	52	5.00	178
5			3.90	91	3.38	57	4.75	156
6			3.80	84	3.31	53	7.76	492
7			3.95	94	3.13	42	5.73	250
8			3.74	80	3.29	51	5.45	221
9			3.59	69	3.31	53	4.75	156
10	8.16	545	3.69	76	3.32	53	4.60	144
11	11.10	975	3.90	91	3.39	57	5.70	247
12	11.10	975	3.88	90	3.32	53	9.01	664
13	10.10	825	3.73	79	3.27	50	6.66	355
14	7.16	415	3.67	75	3.28	51	5.63	239
15	6.16	298	3.71	78	3.33	54	5.12	189
16	6.22	304	3.57	68	3.28	51	4.84	164
17	6.35	318	3.48	63	3.27	50	4.60	144
18	5.70	247	3.43	60	3.24	48	4.36	125
19	5.22	198	3.39	57	3.22	47	4.11	106
20	4.40	128	3.37	56	3.33	54	5.30	206
21	5.32	208	3.41	59	3.22	47	4.04	101
22	4.60	144	3.34	54	3.27	50	4.07	103
23	4.30	120	3.22	47	3.34	54	4.78	158
24	3.80	84	3.18	45	3.69	76	4.50	136
25	4.22	114	3.15	43	4.20	112	4.92	171
26	3.58	69	3.21	47	4.56	141	4.09	104
27	4.10	105	3.29	51	5.65	242	4.04	101
28	4.08	104	3.29	51	6.45	330	4.00	98
29	4.00	98	3.33	54	7.01	397	4.00	98
30	3.50	64	3.31	53	8.25	558	4.07	103
31	3.73	79			11.13	980		

DAILY GAUGE HEIGHT AND DISCHARGE of Battle creek at Tenmile police detachment, for 1916
—*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.14	108	3.57	57	3.42	40	3.50	45
2	3.84	87	3.39	46	3.46	43	3.54	47
3	4.05	102	3.37	44	3.44	41	3.59	48
4	4.74	155	3.62	60	3.59	49	3.63	52
5	4.32	122	3.56	56	3.70	56	3.73	60
6	4.00	98	3.54	53	3.68	55	3.65	55
7	3.80	84	3.39	43	3.62	51	3.75	61
8	3.76	81	3.38	42	3.52	46	3.70	57
9	3.90	91	3.56	53	3.43	41	3.60	50
10	3.95	94	4.48	49	3.52	46	3.70	57
11	3.57	68	4.09	89	3.46	42	3.66	54
12	3.46	62	3.87	73	3.42	40	3.78	63
13	3.53	66	3.74	64	3.42	40	3.78	63
14	3.37	56	3.66	60	3.49	43	3.74	60
15	3.43	60	3.58	54	3.52	46	3.74	60
16	3.37	56	3.52	51	3.46	42	3.71	58
17	3.30	52	3.48	48	3.41	39	3.64	54
18	3.43	60*s*	3.55	53	3.37	36	3.64	54
19	3.96	88	3.81	69	3.39	38	3.60	50
20	3.56	62	3.63	56	3.43	41	3.57	48
21	3.47	56	3.54	50	3.36	38	3.60	50
22	3.44	52	3.51	48	3.43	41	3.65	54
23	3.41	49	3.44	44	3.37	37	3.68	56
24	3.38	47	3.42	42	3.37	37	3.56	48
25	3.43	50	3.45	45	3.41	39	3.58	48
26	3.80	73	3.55	48	3.43	41	3.55	47
27	4.00	87	3.51	46	3.43	41	3.57	48
28	4.26	106	3.45	42	3.52	46	3.60	50
29	3.85	77	3.37	38	3.52	46	3.56	47
30	3.65	61	3.36	37	3.48	42	3.58	48
31	3.56	56	3.42	40	.....	.....	3.60	50*s*

s-s Shifting conditions.

MONTHLY DISCHARGE of Battle creek at Tenmile police detachment, for 1916

(Drainage area 210 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (10-31)	975	64	292	1.390	1.14	12,739
April	98	43	68	0.324	0.36	4,046
May	980	42	130	0.619	0.71	7,993
June	664	98	204	0.971	1.08	12,139
July	155	47	76	0.362	0.42	4,673
August	89	37	52	0.248	0.29	3,197
September	56	36	43	0.205	0.23	2,559
October	63	45	53	0.252	0.29	3,259
The period	.....	.....	.....	.....	4.52	50,605

MONTHLY DISCHARGE in Second-feet of Battle creek at Tenmile police detachment

MONTH	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	11.3	.....	37.0	24.0	11.40	26	39	53	29	1,774
November	.....	12.0*j*	.....	33.0*c*	23.0*e*	.....	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
March	.....	.....	.....	.....	.....	24.00*f*	59*g*	292*h*	.....	.....	.....
April	.....	.....	85.0*b*	269.0*d*	213.0	111.00	109	68	.....	125	7,453
May	.....	.....	51.0	88.0	60.0	34.00	40	130	.....	67	4,122
June	68.0*a*	.....	25.0	43.0	25.0	19.40	82	204	.....	67	3,949
July	37.0	.....	19.1	24.0	17.3	2.70	45	76	.....	32	1,943
August	12.6	.....	14.0	17.7	8.8	1.80	27	52	.....	19	1,176
September	7.8	.....	86.0	19.6	6.1	9.40	30	43	.....	29	1,714
Total in acre-ft.	6,503	999	13,413	29,349	21,959	12,163	23,532	49,744	.....	.....	22,131

a 3-19 and 26-30.
b 21-30.
c 1-7.
d 3-30.
e 1-15.
16-31.
g 16-31.
h 10-31.
j 1-13.

MARSHALL AND GAFF DITCH FROM BATTLE CREEK

Location.—On the NE. ¼ Sec. 33, Tp. 5, Rge. 29, W. 3rd Mer., about two hundred and fifty feet below headgate of ditch.

Records available.—During the irrigation seasons of 1914 and 1915 no water was used by Mrs. Marshall and no daily gauge height records were kept. Records at a point three miles below are given under Gaff ditch. No water used during 1916 season.

Gauge.—Vertical staff driven into the bed of the ditch near the right bank; zero elevation of gauge maintained at 95.02 feet during 1915 and 1916.

Bench-mark.—Permanent iron bench-mark located near the log control of the left bank; assumed elevation 100.00 feet.

Artificial control.—A permanent log control was constructed August 9, 1915, fifty feet below the gauge rod.

Discharge measurements.—Made with meter or weir.

Observer.—Mrs. L. A. Marshall.

Remarks.—Nine visits were made to this station during 1916, but there was no flow at time of each visit, and it is understood that no water was diverted during 1916.

GAFF DITCH FROM BATTLE CREEK

Location.—On the SW. ¼ Sec. 25, Tp. 5, Rge. 29, W. 3rd Mer.

Records available.—For the irrigation seasons of 1912-16.

Gauge.—Vertical staff. The zero elevation of the gauge was maintained at 96.18 feet during 1912 and to October 2, 1915. On October 2, 1915, a new staff gauge was installed, the zero elevation of which is 95.95 feet.

Bench-mark.—A permanent iron bench-mark was set on June 25, 1915, on the section line between sections 25 and 26, about twenty feet north of the ditch; assumed elevation 100.00 feet. Elevation of old B.M. stake as referred to iron B.M., 99.22 feet.

Channel.—Composed of sandy loam.

Discharge measurements.—Made with current-meter by wading or with a weir.

Artificial control.—A log control was built twenty feet below the gauge on October 2, 1915.

Observer.—W. D. Gaff.

Remarks.—Three visits were made to this station during 1916, but there was no flow at time of each visit, and it is understood that no water was diverted during 1916.

F. W. HENRY DITCH FROM BATTLE CREEK

Location.—On the NW. ¼ Sec. 28, Tp. 5, Rge. 28, W. 3rd Mer., near Battle Creek.

Records available.—For the irrigation seasons of 1915 and 1916.

Gauge.—Vertical staff; zero of gauge maintained at 97.97 feet during 1915-16.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Discharge measurements.—Made with a five-foot weir permanently located twenty feet below gauge; elevation of crest maintained at 98.52 feet.

Observer.—F. W. Henry.

Remarks.—There was no flow at each of five visits during 1916, and it is understood that no water was diverted during 1916.

HENRY DITCH FROM HALFWAY COULEE

Location.—On the NW. ¼ Sec. 34, Tp. 5, Rge. 28, W. 3rd Mer., near Battle Creek.

Records available.—For the irrigation seasons of 1915-1916.

Gauge.—Vertical staff; zero elevation of gauge maintained at 96.49 feet since establishment.

Discharge measurements.—Made with a twenty-four-inch sharp-crested rectangular weir, permanently set in the ditch ten feet below the gauge. Crest maintained at elevation of 97.66 feet.

Observer.—F. W. Henry.

DISCHARGE MEASUREMENTS of Henry ditch from Halfway coulee, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 25	P. A. Fetterley					Nil
April 27	H. W. Rowley				1.27	0.21*w*
June 26	do					Nil
Aug. 11	do					"
Aug. 31	do					"
Sept. 26	V. A. Newhall and H. W. Rowley					"

w Discharge determined by using a twenty-four-inch weir.

DAILY GAUGE HEIGHT AND DISCHARGE of Henry ditch from Halfway coulee, for 1916

April			April			May		
Day	Gauge Height	Discharge	Day	Gauge Height	Discharge	Day	Gauge Height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*
19	1.40*h*	0.72	25	1.25	0.15	1	1.27	0.21
20	1.35	0.50	26	1.25	0.15	2	1.26	0.18
21	1.35	0.50	27	1.27	0.21	3	1.26	0.18
22	1.34	0.46	28	1.27	0.21	4	1.25	0.15
23	1.30	0.31	29	1.25	0.15	5	1.25	0.15
24	1.25	0.15	30	1.25	0.15	6	1.25*h*	0.15

h Headgate, open April 19 to May 6.

MONTHLY DISCHARGE of Henry ditch from Halfway coulee, for 1916

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
April (19-30)	0.72	0.15	0.30			7
May (1-6)	0.21	0.15	0.17			2
The period						9

WILSON DITCH FROM BATTLE CREEK

Location.—On the NE. ¼ Sec. 34, Tp. 5, Rge. 28, W. 3rd Mer.
Records available.—Discharge measurements only in 1914. No water used during 1915-16.
Gauge.—Plain staff; zero elevation of gauge 96.28 feet.
Bench-mark.—Permanent iron bench-mark on left bank; assumed elevation 100.00 feet.
Remarks.—Four visits were made during 1916, but there was no flow at time of each visit.

WILKES DITCH FROM BATTLE CREEK

Location.—On the NW. ¼ Sec. 4, Tp. 6, Rge. 27, W. 3rd Mer., one and one-half miles below intake of ditch.
Gauge.—Vertical staff fastened to post driven three feet into bed of ditch near left bank. Zero of gauge maintained at 97.98 feet.
Bench-mark.—Permanent iron bench-mark on left bank, six feet from edge of ditch; assumed elevation 100.00 feet.
Discharge measurements.—Made with a current-meter or with a weir.
Observer.—W. L. Wilkes.
Remarks.—Six visits were made during 1916 and there was no flow at time of each visit.

BATTLE CREEK AT WILKES' RANCH

Location.—On the NW. ¼ Sec. 33, Tp. 5, Rge. 27, W. 3rd Mer., at R. W. Wilkes' ranch, twelve miles east of the Tenmile R.N.W.M.P. Detachment.
Records available.—Open water flow from May 1, 1912, to October 31, 1916. From July, 1910, to November 7, 1911, a station was maintained at W. S. Wilson's ranch, six miles up stream.
Gauge.—Vertical staff. Zero of gauge maintained at 89.86 feet during 1912; zero of gauge maintained at 90.01 feet during 1913-16.
Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet, located on the left bank 750 feet below the gauge.
Channel.—Composed of sand and slightly shifting.
Discharge measurements.—Made by wading.
Winter flow.—Station discontinued during winter season.
Diversions.—Water is diverted above this station for irrigation purposes, by Mrs. L. A. Marshall, J. A. Gaff, Lindner Brothers, W. S. Wilson and F. W. Henry.
Observer.—Mrs. Bertha Wilkes.
Accuracy.—Stage discharge relation practically permanent, affected by ice and shifting bed of stream during April and May.
Rating curve very well defined between 35 and 575 second-feet. Gauge read to hundredths at least once daily. Gauge heights considered reliable after May 12; before this date somewhat questionable.
Daily discharge ascertained by applying mean daily gauge heights to rating table from May 25 to October 31; from March 25 to May 24 obtained by the Bolster method.
Results considered good from May 12 to end of season; other results fair.

DISCHARGE MEASUREMENTS of Battle creek at Wilkes' ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 3	P. A. Fetterley	49	52.8	1.75	4.42	101
April 6	do	46	36.0	1.21	3.48	43
April 13	do	45	92.0	1.12	3.10	103
April 28	H. W. Rowley	27	22.7	2.51	2.48	57*n*
May 12	do	48	43.8	1.12	2.43	59*n*
June 1	do	58	237.0	2.39	5.65	566*n*
June 2	do	53	157.0	2.26	4.54	356*n*
June 27	do	47	84.2	1.28	2.80	108*n*
July 20	do	48	73.6	1.21	2.58	89*n*
Aug. 12	do	46	67.4	1.20	2.50	81*n*
Aug. 31	do	45	48.6	0.82	2.09	40*n*
Sept. 27	Newhall and Rowley	44	48.6	0.78	2.05	38*n*
Nov. 13	H. W. Rowley	47	38.5	0.57	2.34	22*ni*

n Discharge measured at miscellaneous section below gauge.
i Stream frozen over; measurement made under ice.

DAILY GAUGE HEIGHT AND DISCHARGE of Battle creek at Wilkes' ranch, for 1916

DAY	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec-ft.*
1	.....	.....	4.44	103	2.42	52	6.44	726
2	.....	.....	4.27	86	2.58	69	3.92	257
3	.....	.....	4.42	101*d*	2.62	73	3.15	152
4	.....	.....	4.29	100	2.68	79	3.30	171
5	.....	.....	4.27	111	2.64	75	3.79	238
6	.....	.....	3.48	43*d*	2.55	67	4.11	286
7	.....	.....	4.16	127	2.55	67	4.26	310
8	.....	.....	3.79	102	2.51	64	4.51	351
9	.....	.....	3.18	55	2.49	62	5.02	445
10	.....	.....	3.03	56	2.45	61	5.23	485
11	.....	.....	3.03	68	2.42	58	5.76	590
12	.....	.....	3.03	63	2.43	59	5.86	610
13	.....	.....	3.10	103*d*	2.43	61	5.55	548
14	.....	.....	3.27	123	2.38	58	4.61	368
15	.....	.....	3.22	120	2.38	59	4.00	269
16	.....	.....	3.11	109	2.35	57	3.65	218
17	.....	.....	3.08	106	2.35	58	3.48	194
18	.....	.....	2.97	96	2.35	59	3.40	184
19	.....	.....	2.73	72	2.35	60	3.22	161
20	.....	.....	2.68	69	2.28	54	2.97	129
21	.....	.....	2.60	63	2.28	55	2.83	113
22	.....	.....	2.60	64	2.30	58	2.85	115
23	.....	.....	2.61	65	2.30	57	3.06	140
24	.....	.....	2.54	60	2.30	59	3.08	143
25	6.05	324*s*	2.46	54	2.78	108*s*	3.08	143
26	5.83	289	2.36	46	3.08	143	2.99	131
27	5.63	258	2.31	42	3.48	194	2.80	109
28	5.57	249	2.48	57*d*	3.86	248	2.66	95
29	5.19	197	2.12	27	4.38	329	2.74	103
30	4.87	155	2.36	47	5.02	445	2.76	105
31	4.68	131	.....	.....	6.09	656	.....	.....

d Actual measurement.
s-s Shifting conditions.

DAILY GAUGE HEIGHT AND DISCHARGE of Battle creek at Wilkes' ranch, for 1916—*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft*
1	2.36	65	2.30	59	2.03	35	2.10	41
2	2.29	58	2.30	59	2.08	39	2.15	45
3	2.43	72	2.18	47	2.17	47	2.15	45
4	2.97	129	2.18	47	2.30	59	2.25	54
5	3.06	140	2.18	47	2.22	51	2.28	57
6	2.86	116	2.20	59	2.22	51	2.30	59
7	2.86	116	2.17	47	2.22	51	2.32	61
8	2.86	116	2.14	44	2.18	47	2.35	64
9	2.82	111	2.10	41	2.23	52	2.35	64
10	2.64	93	2.41	70	2.28	57	2.37	66
11	2.64	93	2.70	99	2.28	57	2.40	69
12	2.64	93	2.51	80	2.20	49	2.38	67
13	2.64	93	2.46	75	2.32	61	2.35	64
14	2.46	75	2.28	57	2.14	44	2.34	63
15	2.36	65	2.28	57	2.14	44	2.34	63
16	2.25	54	2.28	57	2.07	39	2.29	58
17	2.20	59	2.25	54	2.05	37	2.28	57
18	2.35	64	2.28	57	2.08	39	2.29	58
19	2.65	94	2.33	62	2.08	39	2.29	58
20	2.58	87	2.26	55	2.03	35	2.30	59
21	2.47	76	2.15	45	2.03	35	2.30	59
22	2.24	53	2.15	45	2.06	38	2.27	56
23	2.18	47	2.15	45	2.10	41	2.26	55
24	2.12	43	2.11	42	2.10	41	2.24	53
25	2.08	39	2.11	42	2.10	41	2.26	55
26	2.20	49	2.11	42	2.20	49	2.26	55
27	2.60	89	2.11	42	2.05	37	2.26	55
28	2.82	111	2.07	39	2.05	37	2.26	55
29	2.96	128	2.16	46	2.09	40	2.28	57
30	2.72	101	2.12	43	2.15	45	2.15	45
31	2.52	81	2.07	39			2.26	55

MONTHLY DISCHARGE of Battle creek at Wilkes' ranch, for 1916

(Drainage area 310 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (25-31)	324	39	229	0.739	1.92	3,179
April	127	39	79	0.255	0.28	4,701
May	656	35	116	0.374	0.43	7,133
June	726	41	263	0.848	0.95	15,650
July	140	39	84	0.271	0.31	5,165
August	99	39	53	0.171	0.20	3,259
September	61	35	45	0.145	0.16	2,678
October	69	41	57	0.184	0.21	3,505
The period					4.46	45,270

GILCHRIST BROTHERS' DITCH FROM BATTLE CREEK

Location.—On the SW. ¼ Sec. 11, Tp. 5, Rge. 27, W. 3rd Mer., at the intake of Gilchrist Brothers' ditch near Consul.

Records available.—For the irrigation seasons of 1914-1916.

Gauge.—Vertical staff; the zero of the gauge has been maintained at 95.81 feet since establishment.

Bench-mark.—Permanent iron bench-mark located on the right bank near the gauge; assumed elevation 100.00 feet.

Discharge measurements.—Made with a current-meter in the flume, or with a weir just below the flume.

Observer.—W. F. Gilchrist.

Remarks.—Four visits were made during 1916, but there was no flow at time of each visit, and it is understood that no water was diverted during 1916.

RICHARDSON DITCH FROM BATTLE CREEK

Location.—On the SE. ¼ Sec. 2, Tp. 5, Rge. 27, W. 3rd Mer., near Consul.

Records available.—October 14, 1911, to October 31, 1916.

Gauge.—Vertical staff. The zero of the gauge has been maintained at 97.03 feet since establishment.

Bench-mark.—Permanent iron bench-mark located on the left bank of the ditch at the gauge; assumed elevation 100.00 feet.

Channel.—Composed of clay loam and overgrown with grass.

Discharge measurements.—Made with a current-meter or with a weir.

Observer.—L. E. Richardson.

Remarks.—There was no flow at each of the visits of the district engineer during 1916, and it is understood that no water was diverted during 1916.

J. MCKINNON DITCH FROM BATTLE CREEK

Location.—On the NW. ¼ Sec. 20, Tp. 4, Rge. 26, W. 3rd Mer., near Consul.

Records available.—No water has been used since station was established.

Gauge.—Vertical staff driven into bed of ditch near the left bank; elevation of zero maintained at 96.07 feet during 1915.

Bench-mark.—During 1915 a permanent iron bench-mark was installed two feet east of the old wooden bench-mark; assumed elevation 100.00 feet.

Discharge measurements.—Made with current-meter or weir.

Artificial control.—The lateral gate near the station will affect the flow at the gauge.

Observer.—James McKinnon.

Remarks.—Seven visits were made to this station during 1916 but there was no flow at time of each visit, and it is understood that no water was diverted during 1916.

STIRLING AND NASH DITCH FROM BATTLE CREEK

Location.—On the SE. ¼ Sec. 22, Tp. 3, Rge. 27, W. 3rd Mer., at R. J. Stirling's ranch, near Consul.

Records available.—This station was established July 11, 1911. The ditch was used from July 11 to August 17, 1911; from July 3 to August 20, 1912; and from June 28 to July 19, 1913. But sufficient discharge measurements were not made during 1911-13 to estimate the daily discharge; the only daily discharge records available are for 1914-1916.

Gauge.—Vertical staff. Zero elevation of the gauge has been maintained at 94.43 feet since establishment.

Bench-mark.—A permanent iron bench-mark on the right bank; assumed elevation 100.00 feet.

Channel.—Uniform and in good condition.

Discharge measurements.—Made with current-meter or with a weir.

Artificial control.—On May 21, 1915, a control was constructed thirty feet below the gauge consisting of plank piling, driven, end to end, at right angles to ditch, with surface outline about eight inches above the contour of ditch.

Observer.—R. J. Stirling.

DISCHARGE MEASUREMENTS of Stirling and Nash ditch from Battle creek, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 29	H. W. Rowley	.....	.....	.....	Dry	Nil
May 13	do	.....	.....	.....	Dry	Nil
June 30	do	11	10.8	0.54	1.81	5.80
July 21	do	.....	.....	.....	Dry	Nil
Aug. 14	do	.....	.....	.....	"	"
Sept. 1	do	.....	.....	.....	"	"
Sept. 28	V. A. Newhall and H. W. Rowley	.....	.....	.....	"	"
Nov. 14	H. W. Rowley	.....	.....	.....	"	"

DAILY GAUGE HEIGHT AND DISCHARGE of Stirling and Nash ditch from Battle creek, for 1916

JUNE			JULY			JULY		
Day	Gauge Height	Discharge	Day	Gauge Height	Discharge	Day	Gauge Height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*
27	1.68*h*	4.2	1	1.36	1.50	10	1.72*h*	4.70
28	1.83	6.1	2	1.32	1.20	11	1.71*x*	4.60
29	1.81	5.8	3	1.46	2.20	12	1.57	3.10
30	1.76	5.2	4	1.67	4.10	13	1.36	1.50
.....	.....	.....	5	1.73	4.80	14	1.23	0.76
.....	.....	.....	6	1.73	4.80	15	0.99	Nil
.....	.....	.....	7	1.73	4.80	16	0.77	"
.....	.....	.....	8	1.73	4.80	17	1.52	2.60
.....	.....	.....	9	1.73	4.80	18	1.72*x*	4.70

h Headgate open from June 27 to July 10.
x Local run-off July 11-18.

MONTHLY DISCHARGE of Stirling and Nash ditch from Battle creek, for 1916

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
June (27-30)	6.1	4.2	5.3	.....	.....	42
July (1-18)	4.8	Nil	3.1	.....	.....	111
The period	.....	.....	.....	.....	.....	153

BATTLE CREEK AT NASH'S RANCH

Location.—On the NE. ¼ Sec. 3, Tp. 3, Rge. 27, W. 3rd Mer., at E. R. Nash's ranch (Nashlyn post office).

Records available.—Open water flow from May 11, 1910, to October 31, 1916.

Gauge.—Vertical staff; elevation of zero maintained at 90.23 feet since establishment.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—Slightly shifting.

Discharge measurements.—Made from highway bridge, one-quarter mile below gauge, by wading 200 feet below gauge or with weir, depending on stage of stream.

Winter flow.—Station discontinued during winter season.

Diversions.—Water is diverted for irrigation by Jas. McKinnon, Jr., Mrs. S. J. Richardson, Gilchrist brothers, Stirling and Nash, and L. E. Richardson, between this station and the station at Wilkes' ranch.

Observer.—E. R. Nash.

Accuracy.—Stage—discharge relation practically permanent, affected by ice during short periods in February and March while ice was going out.

Rating curve well defined between 35 second-feet and 700 second-feet. Above this and during period February 27 to March 14, records are subject to small error. Gauge read to hundredths daily, twice daily during fluctuating flood stages. Daily discharge ascertained by applying mean daily gauge heights to rating table.

Results very good except for period of break-up.

DISCHARGE MEASUREMENTS of Battle creek at Nash's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 31	H. W. Rowley	58.0	232.0	2.98	5.77	691*n*
April 3	do	31.3	114.0	2.59	3.46	295*n*
April 10	do	35.0	60.2	2.18	1.99	131*n*
April 14	do	35.0	55.4	2.11	1.83	117*n*
May 1	do	33.0	34.5	1.94	1.31	67*n*
May 13	do	38.0	41.8	1.53	1.29	64*n*
June 3	do	35.7	148.0	2.59	3.95	383*n*
June 30	do	43.0	62.0	1.81	1.90	112*n*
July 21	do	43.0	62.6	1.80	1.87	113*n*
Aug. 14	do	40.0	42.9	1.63	1.39	70*n*
Sept. 1	do	37.0	32.0	1.22	1.10	39*n*
Sept. 28	do	35.5	32.9	1.18	1.04	39*n*
Oct. 25	do	37.0	39.5	1.37	1.24	54*n*
Nov. 14	do	35.0	28.8	0.90	1.32	26*in*

i Creek frozen over.
n Discharge measured at miscellaneous section below gauge.

DAILY GAUGE HEIGHT AND DISCHARGE of Battle creek at Nash's ranch, for 1916

DAY	February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	3.70	332	4.95	532	1.30	60	5.42	622
2	.....	.....	3.93	364	4.15	398	1.30	60	6.18	774
3	.....	.....	4.04	381	3.48	303	1.25	56	3.79	345
4	.....	.....	4.00	375	2.93	234	1.32	62	3.25	374
5	.....	.....	3.96	369	2.59	195	1.35	65	2.95	236
6	.....	.....	3.74	338	2.36	170	1.35	65	2.25	158
7	.....	.....	3.96	369	2.34	167	1.27	57	2.45	180
8	.....	.....	3.60	319	1.97	127	1.30	60	3.65	326
9	.....	.....	3.64	324	1.74	104	1.22	53	3.00	242
10	.....	.....	3.65	326	1.97	127	1.25	56	2.72	209
11	.....	.....	3.35	286	1.95	125	1.25	56	2.45	180
12	.....	.....	3.40	293	1.92	122	1.32	62	2.45	180
13	.....	.....	5.14	568	1.94	124	1.27	57	4.05	382
14	.....	.....	10.94	1,726	1.90	120	1.25	56	4.95	532
15	.....	.....	9.96	1,530	1.80	110	1.25	56	3.60	319
16	.....	.....	8.92	1,322	1.78	108	1.25	56	3.02	244
17	.....	.....	7.08	954	1.79	109	1.25	56	2.70	207
18	.....	.....	7.14	966	1.75	105	1.25	56	2.45	180
19	.....	.....	6.60	858	1.67	97	1.22	53	2.25	158
20	.....	.....	6.27	792	1.55	85	1.20	51	2.15	146
21	.....	.....	6.31	800	1.50	80	1.17	48	2.02	132
22	.....	.....	6.35	808	1.52	82	1.18	49	2.00	130
23	.....	.....	8.23	1,184	1.40	70	1.15	46	2.05	136
24	.....	.....	7.48	1,034	1.36	66	1.14	46	2.02	132
25	.....	.....	6.15	768	1.34	64	1.26	56	2.40	174
26	.....	.....	6.03	744	1.30	60	1.90	120	2.15	146
27	4.50	454	7.79	1,096	1.27	57	2.35	168	1.94	124
28	4.60	470	8.98	1,334	1.26	56	2.66	203	1.82	112
29	4.08	387	8.43	1,224	1.25	56	3.00	242	1.73	103
30	.....	.....	6.97	932	1.25	56	3.69	331	1.90	120
31	.....	.....	5.90	718	.....	.....	4.52	457	.....	.....

DAILY GAUGE HEIGHT AND DISCHARGE of Battle creek at Nash's ranch, for 1916—*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.00	130	1.35	65	1.10	42	1.05	38
2	2.04	134	1.30	60	1.10	42	1.07	39
3	1.85	115	1.26	56	1.12	44	1.15	46
4	1.80	110	1.17	48	1.18	49	1.22	53
5	1.80	110	1.15	46	1.20	51	1.30	60
6	2.15	146	1.15	46	1.25	56	1.34	64
7	1.90	120	1.15	46	1.21	52	1.36	66
8	1.73	103	1.15	46	1.32	62	1.30	60
9	1.70	100	1.35	65	1.22	53	1.34	64
10	1.65	95	1.29	59	1.18	49	1.33	63
11	1.60	90	1.25	56	1.15	46	1.25	56
12	1.65	95	1.75	105	1.15	46	1.25	56
13	1.50	80	1.60	90	1.12	44	1.22	53
14	1.42	72	1.45	75	1.15	46	1.30	60
15	1.35	65	1.36	66	1.16	47	1.34	64
16	1.30	60	1.28	58	1.16	47	1.34	64
17	2.40	174	1.25	56	1.16	47	1.28	58
18	3.80	346	1.24	55	1.15	46	1.25	56
19	1.70	100	1.23	54	1.15	46	1.25	56
20	1.60	90	1.18	49	1.15	46	1.23	54
21	2.00	130	1.35	65	1.14	46	1.23	54
22	1.65	95	1.28	58	1.05	38	1.21	52
23	1.40	70	1.21	52	1.06	39	1.23	54
24	1.35	65	1.26	56	1.05	38	1.25	56
25	1.23	54	1.26	56	1.05	38	1.24	55
26	1.15	46	1.20	51	1.05	38	1.24	55
27	1.23	54	1.15	46	1.05	38	1.23	54
28	1.18	49	1.15	46	1.04	37	1.23	54
29	1.20	51	1.21	52	1.05	38	1.23	54
30	2.02	132	1.19	50	1.05	38	1.22	53
31	1.60	90	1.15	46			1.22	53

MONTHLY DISCHARGE of Battle creek at Nash's ranch, for 1916

(Drainage area 500 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
February (27-29)	470	387	437	0.874	0.10	2,600
March	1,726	286	756	1.510	1.74	46,485
April	532	56	137	0.274	0.31	8,152
May	457	46	94	0.188	0.22	5,780
June	774	103	243	0.486	0.54	14,460
July	346	46	102	0.204	0.24	6,272
August	105	46	57	0.114	0.13	3,505
September	62	37	45	0.090	0.10	2,678
October	66	38	56	0.112	0.13	3,443
The period					3.51	93,375

MEAN MONTHLY DISCHARGE of Battle creek at Nash's ranch

(Area of Watershed, 500 square miles)
(Average Run-off per square mile, 96.9 acre-ft.)

YEAR	Feb. Sec.-ft.	Mar. Sec.-ft.	April Sec.-ft.	May Sec.-ft.	June Sec.-ft.	July Sec.-ft.	Aug. Sec.-ft.	Sept. Sec.-ft.	Oct. Sec.-ft.	Nov. Sec.-ft.	Total Acre-ft.
1910	.....	.....	.....	*14a*	2.6	*0.9a*	*1.8a*	5	4	14*b*	*2,405a*
1911	.....	.....	104	46	11.0	9.0	10.0	118	38	47*b*	21,498
1912	.....	.....	612*c*	90	37.0	8.0	11.0	17	24	.....	38,030
1913	.....	.....	339	55	13.0	21.0	9.0	5	12	.....	27,290
1914	.....	25*b*	142	26	1.0	0.0	0.0	3	17	.....	12,830
1915	.....	80*b*	230	36	87.0	52.0	25.0	25	28	.....	33,925
1916	437*a*	756	137	94	243.0	102.0	57.0	45	56	.....	93,375
Average Sec.-ft.	.....	287	261	58	56	32	19	31	26	30	37,825
Average acre-ft.	.....	17,647	15,531	3,566	3,332	1,968	1,168	1,845	1,599	1,785	48,441

a Records incomplete; omitted from average.
b Reduced to monthly average.
c Estimated monthly average.
NOTE:—High discharge for 1911 and 1913 computed from slope measurements.

MISCELLANEOUS DISCHARGE MEASUREMENTS made in Battle creek drainage basin, in 1916

Date	Engineer	Stream	Location	Width	Area of Section	Mean Velocity	Discharge
				Feet	*Sq. ft.*	*Ft. per sec.*	*Sec.-ft.*
Aug. 11	H. W. Rowley	Sixmile creek	Sec. 12-8-29-3	5	7.15	1.55	11.10
May 11	do	Tenmile creek	Sec. 4-6-29-3	.....	.....	.....	0.49*w*
May 31	do	do	do	9	10.80	1.13	12.20
June 26	do	do	do	.....	.....	.....	0.50*w*
July 18	do	do	do	.....	.....	.....	0.43*w*
Aug. 9	do	do	do	.....	.....	.....	0.50*w*
Aug. 29	do	do	do	.....	.....	.....	0.19*w*
Sept. 23	do	do	do	.....	.....	.....	Nil
Oct. 10	do	do	do	.....	.....	.....	"

w Discharge determined by using a weir.

FRENCHMAN RIVER DRAINAGE BASIN

General Description

Frenchman river drains a large portion of Southwestern Saskatchewan. It rises in Cypress lake in Township 6, Range 26, West of the 3rd Meridian, and follows a southeasterly course for some 150 miles, crossing into the United States in Range 10, West of 3rd Meridian. It eventually finds its way into Milk river near Saco, Montana, U.S.A., and therefore forms a part of the general drainage basin of the Missouri.

Cypress lake is on the southern slope of Cypress hills at an elevation of about 3,155 feet above sea-level. It occupies what is probably a portion of an abandoned water course or channel of an ancient river, which joined Battle creek to the Frenchman river. The water of the lake is fresh and is supplied by a number of coulees and small streams which head in the hills in the north. The largest of these are Oxarart and Sucker creeks, both of which have a small continuous flow.

During dry years Cypress lake does not overflow, and the whole discharge of the Frenchman river is derived from Belanger, Davis and Fairwell creeks and the north branch. From Township 6, Range 23, West of the 3rd Meridian, where the north branch joins the main stream, there is no appreciable increase in the flow of the river while in Canada. Mule creek, which joins the river in Township 5, Range 17, West of 3rd Meridian, and Snake creek, in Township 3, Range 13, West of 3rd Meridian, however, have small flows.

The country surrounding Cypress lake is of rolling prairie much broken by coulees. In many

of these there is considerable tree growth, but for the most part the country is devoid of all vegetation other than grasses. All the streams in the upper section of the drainage basin, with the exception of the north branch, rise on the plateau at the top of the hills. Flowing southward they break through deep, well-wooded gorges before reaching the lower flats along the river. The north branch, however, is in a deep valley throughout its entire length. Its feeders, like the western tributaries of the main stream, cut from the bench to the valley in deep, well-wooded coulees. Below the mouth of the north branch there is little tree growth. Here and there along the river may be found small growths of shrubs and maple, while up on the hillsides in some of the coulees there are small clumps of poplar covering about an acre. Most of these coulees are rapidly becoming cleared by the settlers who are taking up the bench lands above the river valley. The benches are well covered with grasses, but the hills and sides of the valley are almost devoid of all vegetation. In the flats along the river, except where irrigated, the chief vegetation consists of sage brush and cactus.

When the Frenchman leaves the lake, it flows through a wide flat valley as far as the mouth of Fairwell creek; most of this land is under proposed or constructed irrigation ditches. Below this point the valley becomes more broken and narrows considerably, while the side hills become higher. Small portions of this bottom will no doubt be brought under irrigation, but as yet little has been done in that direction. Below the junction of the north branch, the valley becomes rough and rugged, the sides being cut with buttes and deep coulees. Here numerous outcroppings of lignite may be seen and also a deep seam of light-coloured clay and sand. This seam, which has been bleached almost a pure white, shows at many points along the river's entire course and is one of the most conspicuous objects in this region. From its colour and nature the river receives its local name of the "Whitemud."

At East End, some miles lower down, the valley again widens out into flats. Here is located the largest irrigation project in the Cypress Hills district. Mr. J. C. Strong has a large dam in the river and a system of ditches and storage reservoirs, which irrigate a large part of the flat. Directly above this project there are two smaller irrigation schemes and just below Messrs. Morrison Brothers have a dam and ditch which will irrigate a large area. Their ditch is carried across the river and continued by Messrs. Duncan and Watson who irrigate another large area.

Below the East End flat none of the flats, which occur at various points along the river, are irrigated as yet. A short distance below the mouth of Snake creek the river enters bad lands which continue into the United States.

On most of the tributary streams above East End and on some below that point there are irrigation schemes covering areas of various sizes.

The mean annual rainfall of this basin is not well established, but it is estimated that it would range from 12 to 16 inches, most of which falls in May, June and July. From November to April the streams are frozen over and usually there is an abundant snowfall.

The construction of the Weyburn-Lethbridge branch of the Canadian Pacific Railway, through the upper part of the valley, has opened up that part of the drainage basin, and grain growing is increasing.

MAPLE CREEK CATTLE COMPANY DITCH FROM OXARART CREEK

Location.—On the NE. ¼ Sec. 20, Tp. 6, Rge. 27, W. 3rd Mer., 600 feet below intake of ditch.

Records available.—June 27 to close of 1916 season.

Gauge.—Vertical staff fastened to post driven into bed of ditch near left bank; zero of gauge maintained at 3,183.37 feet.

Bench-mark.—Permanent iron bench-mark located at gauging station on Oxarart creek at Wylie's ranch; elevation 3,203.75 feet above mean sea-level. (Irrigation surveys.)

Artificial control.—Thirty-six-inch, rectangular, sharp-crested weir located six feet below gauge; elevation of crest 3,184.37 feet.

Observer.—Mrs. R. Wylie.

Remarks.—There was no discharge at each of the six visits of the district engineer during 1916.

DAILY GAUGE HEIGHT AND DISCHARGE of Maple Creek Cattle Company ditch from Oxarart creek, for 1916

JUNE			JULY		
Day	Gauge Height	Discharge	Day	Gauge Height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*
27	1.10*x*	0.31	1	1.12	0.39
28	1.10	0.31	2	1.11	0.36
29	1.10	0.31	3	1.12	0.39
30	1.12	0.39	4	1.14	0.52
			5	1.13	0.47
			6	1.12	0.39
			7	1.10	0.31
			8	1.10	0.31
				h	

x Station established, June 27, 1916.
h Headgate closed July 9 to close of season.

MONTHLY DISCHARGE of Maple Creek Cattle Company ditch from Oxarart creek, for 1916

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
June (27-30*x*)	0.39	0.31	0.33			3
July (1-8)	0.52	0.31	0.39			6
The period						9

x Station established, June 27, 1916.

OXARART CREEK AT WYLIE'S RANCH

Location.—On the NE. ¼ Sec. 20, Tp. 6, Rge. 27, W. 3rd Mer., at Joseph Wylie's ranch.

Records available.—The open water seasons, beginning June 15, 1909, to November 11, 1916.

Gauge.—Vertical staff; zero of gauge maintained at 3,199.02 feet during 1909-10, at 3,199.06 feet during 1911, and at 3,199.03 feet during 1912 and to April 27, 1916. On April 28, 1916, the gauge was moved five hundred feet down stream and the zero of the gauge maintained at 3,186.60 feet balance of season.

Bench-mark.—Permanent iron bench-mark located on the right bank at original location of gauge; elevation 3,203.75 feet above mean sea-level (Irrigation Surveys).

Discharge measurements.—Made with current-meter, by wading at miscellaneous section, or with weir during very low stages.

Winter flow.—Station is not maintained during winter season.

Artificial control.—The thirty-six-inch weir established August 5, 1915, was carried away early in the spring of 1916 by ice and was not replaced.

Accuracy.—Stage-discharge relation; affected by ice and floods in February and March; April 28 to close of season, permanent. Rating curve well defined from 1.30 to 32 second-feet. Gauge read to hundredths twice daily during fluctuating stages; otherwise once daily. Daily discharge ascertained from rating curve by applying corrections for shifting conditions, March 25 to 31 and April 3 to 8; estimated April 1-2; by applying mean daily gauge heights to rating tables, March 5 to 24 and April 9 to November 11.

Observer.—Robert Gordon.

Remarks.—Creek broke up about February 15, but no gauge heights recorded until March 5. Records discontinued November 11, although small flow in creek.

DISCHARGE MEASUREMENTS of Oxarart creek at Wylie's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 24	P. A. Fetterley	18.0	16.20	0.77	1.24	12.40*m*
Mar. 25	do	18.0	25.30	1.83	1.81	46.00*m*
April 3	do	18.0	15.80	0.72	1.01	11.40*m*
April 8	do	17.5	11.20	0.36	0.93	4.10*m*
April 12	do	17.7	17.60	1.02	1.36	17.80*m*
April 28	H. W. Rowley	12.0	4.60	0.91	0.70	4.20*m*
May 12	do	11.0	4.10	0.76	0.67	3.10*m*
June 1	do	13.0	9.60	2.08	1.04	20.00*n*
June 27	do	12.0	5.60	1.27	0.78	7.10
July 20	do	12.0	4.00	0.82	0.68	3.30*n*
Aug. 12	do	11.0	4.10	0.68	0.65	2.80*n*
Aug. 31	do	12.0	3.80	0.58	0.60	2.20*n*
Sept. 27	V. A. Newhall and H. W. Rowley	11.0	3.20	0.39	0.56	1.26*n*
Nov. 13	H. W. Rowley	.....	.....	.....	0.61	1.30*w*

m Discharge was measured at miscellaneous sections above gauge.
n Discharge was measured at miscellaneous sections below the gauge.
w Discharge determined by using a 36-inch weir.

DAILY GAUGE HEIGHT AND DISCHARGE of Oxarart creek at Wylie's ranch, for 1916

Day	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	0.51	2.5*e*	0.70	4.0	1.04	20.0
2	.....	.....	0.31	2.5*e*	0.70	4.0	1.01	18.3
3	.....	.....	1.36	29.0	0.70	4.0	0.96	15.7
4	.....	.....	1.36	28.0	0.70	4.0	0.90	12.7
5	1.11	8.3	0.96	8.0	0.70	4.0	0.95	15.2
6	1.11	8.3	0.96	7.0	0.70	4.0	1.21	30.0
7	1.11	8.3	1.09	9.2*s*	0.70	4.0	1.02	18.8
8	1.61	33.0	1.11	8.3	0.70	4.0	0.93	14.2
9	2.21	75.0	1.06	7.0	0.70	4.0	0.86	10.8
10	2.16	71.0	1.09	7.8	0.70	4.0	0.92	13.7
11	3.06	134.0	1.16	9.7	0.70	4.0	1.05	20.0
12	1.81	47.0	1.21	11.3	0.68	3.5	1.18	28.0
13	2.31	82.0	1.33	16.4	0.68	3.5	1.25	32.0
14	1.91	54.0	1.41	21.0	0.66	3.0	1.08	22.0
15	1.51	26.0	1.33	16.4	0.65	2.7	0.98	16.8
16	1.36	17.9	1.23	12.0	0.65	2.7	0.92	13.7
17	1.66	36.0	1.13	8.8	0.65	2.7	0.89	12.2
18	1.06	7.0	1.31	15.5	0.65	2.7	0.86	10.8
19	1.03	6.3	1.16	9.7	0.65	2.7	0.82	8.9
20	1.23	12.0	1.01	5.8	0.65	2.7	0.80	8.0
21	1.82	47.0	1.05	6.8	0.65	2.7	0.80	8.0
22	1.87	51.0	1.02	6.1	0.65	2.7	0.84	9.8
23	1.86	50.0	1.00	5.6	0.64	2.5	0.90	12.7
24	1.47	24.0	1.05	6.8	0.64	2.5	0.89	12.2
25	1.46	23.0	1.00	5.6	0.65	2.7	0.84	9.8
26	1.36	19.7*s*	0.90	3.5	0.85	10.3	0.78	7.1
27	1.46	27.0	0.85	2.6	1.05	20.0	0.78	7.1
28	1.46	29.0	0.70	4.0*x*	0.95	15.2	0.77	6.7
29	1.41	28.0	0.70	4.0	0.97	16.2	0.78	7.1
30	1.13	14.5	0.70	4.0	1.02	18.8	0.84	9.8
31	0.81	5.3	.....	.....	1.04	20.0	.....	.....

e Discharge estimated.
s Shifting conditions.
x New station established 500 feet down stream.

DAILY GAUGE HEIGHT AND DISCHARGE of Oxarart creek at Wylie's ranch, for 1916.—*Concluded.*

DAY	July		August		September		October		November	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	0.85	10.3	0.68	3.50	0.60	1.90	0.56	1.42	0.55	1.30
2	0.84	9.8	0.65	2.70	0.60	1.90	0.57	1.54	0.55	1.30
3	0.84	9.8	0.65	2.70	0.59	1.78	0.58	1.66	0.55	1.30
4	0.86	10.8	0.65	2.70	0.60	1.90	0.58	1.66	0.55	1.30
5	0.84	9.8	0.65	2.70	0.60	1.90	0.57	1.54	0.54	1.22
6	0.80	8.0	0.65	2.70	0.60	1.90	0.58	1.66	0.54	1.22
7	0.76	6.2	0.65	2.70	0.60	1.90	0.60	1.90	0.54	1.22
8	0.75	5.8	0.65	2.70	0.60	1.90	0.60	1.90	0.54	1.22
9	0.75	5.8	0.66	3.00	0.60	1.90	0.59	1.78	0.54	1.22
10	0.75	5.8	0.66	3.00	0.60	1.90	0.58	1.66	0.54	1.22
11	0.74	5.4	0.65	2.70	0.59	1.78	0.57	1.54	0.54	1.22
12	0.72	4.7	0.65	2.70	0.59	1.78	0.56	1.42	.....	.....
13	0.72	4.7	0.65	2.70	0.59	1.78	0.56	1.42	.....	.....
14	0.72	4.7	0.65	2.70	0.59	1.78	0.56	1.42	.....	.....
15	0.71	4.4	0.65	2.70	0.59	1.78	0.56	1.42	.....	.....
16	0.68	3.5	0.65	2.70	0.59	1.78	0.55	1.30	.....	.....
17	0.68	3.5	0.64	2.50	0.59	1.78	0.55	1.30	.....	.....
18	0.68	3.5	0.63	2.40	0.60	1.90	0.55	1.30	.....	.....
19	0.70	4.0	0.63	2.40	0.63	2.40	0.55	1.30	.....	.....
20	0.70	4.0	0.63	2.40	0.67	3.20	0.55	1.30	.....	.....
21	0.70	4.0	0.63	2.40	0.67	3.20	0.56	1.42	.....	.....
22	0.70	4.0	0.63	2.40	0.67	3.20	0.56	1.42	.....	.....
23	0.70	4.0	0.63	2.40	0.66	3.00	0.56	1.42	.....	.....
24	0.70	4.0	0.63	2.40	0.66	3.00	0.56	1.42	.....	.....
25	0.80	8.0	0.63	2.40	0.66	3.00	0.56	1.42	.....	.....
26	0.90	12.7	0.63	2.40	0.67	3.20	0.56	1.42	.....	.....
27	1.10	23.0	.....	2.30*e*	0.56	1.42	0.56	1.42	.....	.....
28	0.90	12.7	.....	2.20*e*	0.56	1.42	0.55	1.30	.....	.....
29	0.80	8.0	.....	2.10*e*	0.56	1.42	0.55	1.30	.....	.....
30	0.72	4.7	.....	2.00*e*	0.56	1.42	0.55	1.30	.....	.....
31	0.70	4.0	0.60	1.90	.....	.....	0.55	1.30	.....	.....

e Discharge estimated.

MONTHLY DISCHARGE of Oxarart creek at Wylie's ranch, for 1916

(Drainage area 77 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (5-31)	134.00	5.30	35.00	0.450	0.46	1,873
April	29.00	2.50	9.50	0.123	0.14	565
May	20.00	2.50	5.90	0.077	0.09	363
June	32.00	6.70	14.40	0.187	0.21	857
July	23.00	3.50	6.90	0.090	0.10	424
August	3.50	1.90	2.60	0.034	0.04	160
September	3.20	1.42	2.10	0.027	0.03	125
October	1.90	1.30	1.47	0.019	0.02	90
November (1-11)	1.30	1.22	1.25	0.016	0.01	27
The period	.....	.....	.....	.....	1.10	4,484

MEAN MONTHLY DISCHARGE in Second-feet of Oxarart creek at Wylie's ranch

MONTH	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	1.93	0.68	0.80	0.54	0.76	0.86	4.30	1.47	1.42	87
Nov.	.....	1.31*b*	.....	0.80*c*	0.41*e*	.....	.....	.....	1.25*k*	.....	.....
Dec.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
March	.....	.....	.....	.....	.....	0.55*f*	6.00*g*	35.00*h*	.....	.....	.....
April	.....	5.40	12.40	87.00*d*	27.00	7.60	16.70	9.50	.....	13.10	785
May	.....	2.50	4.10	8.00	4.60	3.00	6.10	5.90	.....	4.90	300
June	.....	1.50	2.20	4.60	4.50	2.30	5.10	14.40	.....	4.90	295
July	4.70*a*	0.84	1.50	1.88	2.10	0.76	3.80	6.90	.....	2.50	156
August	3.50	0.71	0.90	1.14	1.13	0.52	2.80	2.60	.....	1.66	102
Sept.	2.10	0.70	1.60	1.10	0.72	0.35	4.10	2.10	.....	1.60	95
Total in Acre-feet	462	866	1,403	5,047	2,472	922	2,483	4,631	.....	.....	1,820

a 19-31.
b 1-16.
c 1-15.
d 8-30.
e 1-15.
f 28-31.
g 23-31.
h 5-31.
k 1-11.

SUCKER CREEK AT GILCHRIST'S RANCH

Location.—On the NW. ¼ Sec. 24, Tp. 6, Rge. 26, W. 3 Mer.

Records available.—May 25, 1909, to November 9, 1916.

Gauge.—Vertical staff. Elevation of the zero of the present gauge has been maintained at 3,191.11 feet since April 1912. Elevation of the old gauge, two hundred feet below, was 3,189.20 feet.

Bench-mark.—Permanent iron bench-mark. Elevation 3,196.25 feet above mean sea-level. (Irrigation Surveys.)

Channel.—Slightly shifting.

Discharge measurements.—Made by current-meter and weir in low stages.

Winter flow.—This station is not maintained during winter.

Observer.—J. D. Gilchrist.

DISCHARGE MEASUREMENTS of Sucker creek at Gilchrist's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 6	M. H. French	8.5	4.65	1.89	1.12	8.8
May 11	J. E. Caughey	6.7	4.07	0.88	1.01	3.6
June 10	do	8.0	8.70	1.62	1.20	14.1
July 12	do	7.3	4.26	0.50	0.99	3.6
Oct. 24	L. P. B. Miles	8.0	3.00	1.89	1.09	5.7

DAILY GAUGE HEIGHT AND DISCHARGE of Sucker creek at Gilchrist's ranch, for 1916

DAY	April		May		June		July	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.29	21.0	1.17	12.0	1.30	22.00	1.00	3.6
2	1.20	14.1	1.06	5.8	1.20	14.10	1.20	14.1
3	1.20	14.1	1.17	12.0	1.00	3.60	1.20	14.1
4	1.18	12.7	1.27	19.6	1.30	22.00	1.00	3.6
5	1.15	10.6	1.17	12.0	2.00	78.00	1.00	3.6
6	1.14	10.0	1.07	6.3	1.60	46.00	1.00	3.6
7	1.14	10.0	1.07	6.3	1.30	22.00	1.80	62.0
8	1.14	10.0	1.05	5.4	1.00	3.60	1.20	14.1
9	1.15	10.6	1.06	5.8	0.98	3.10	1.10	7.6
10	1.30	22.0	1.06	5.8	1.40	30.00	1.00	3.6
11	1.35	26.0	1.40	30.0	1.30	22.00	1.00	3.6
12	1.38	28.0	1.20	14.1	1.00	3.60	0.98	3.1
13	1.24	17.2	1.10	7.6	0.99	3.30	0.98	3.1
14	1.30	22.0	1.00	3.6	1.40	30.00	0.96	2.5
15	1.28	20.0	1.10	7.6	1.20	14.10	0.97	2.8
16	1.28	20.0	1.10	7.6	1.10	7.60	0.97	2.8
17	1.15	10.6	1.30	22.0	1.40	30.00	1.20	14.1
18	1.29	21.0	1.10	7.6	1.50	38.00	1.10	7.6
19	1.20	14.1	0.99	3.3	1.30	22.00	1.00	3.6
20	1.15	10.6	0.98	3.1	1.40	30.00	1.00	3.6
21	1.12	8.8	1.20	14.1	1.60	46.00	0.98	3.1
22	1.11	8.2	1.10	7.6	2.00	78.00	0.96	2.5
23	1.10	7.6	1.10	7.6	1.80	62.00	0.95	2.3
24	1.09	7.2	1.15	10.6	1.00	3.60	0.97	2.8
25	1.07	6.3	1.30	22.0	1.00	3.60	0.97	2.8
26	1.06	5.8	1.35	26.0	0.86	0.77	0.97	2.8
27	1.06	5.8	1.78	60.0	1.20	14.10	0.95	2.3
28	1.07	6.3	1.65	50.0	1.00	3.60	0.95	2.3
29	1.06	5.8	1.64	49.0	1.40	30.00	0.96	2.5
30	1.16	11.3	2.00	78.0	1.00	3.60	1.10	7.6
31	.....	.....	1.50	38.0	.....	.....	1.00	3.6

DAILY GAUGE HEIGHT AND DISCHARGE of Sucker creek at Gilchrist's ranch, for 1916—*Concluded*

DAY	August		September		October		November	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.00	3.60	0.89	1.17	1.30	22.0	0.94	2.1
2	0.96	2.50	0.90	1.30	1.40	30.0	0.94	2.1
3	0.96	2.50	0.90	1.30	1.60	46.0	0.95	2.3
4	0.94	2.10	0.87	0.90	1.06	5.8	0.95	2.3
5	0.94	2.10	0.88	1.14	1.07	6.3	0.95	2.3
6	0.96	2.50	0.89	1.17	1.09	7.2	0.94	2.1
7	0.93	1.88	0.89	1.17	1.08	6.7	0.94	2.1
8	0.87	0.90	0.89	1.17	1.08	6.7	0.94	2.1
9	0.86	0.77	0.86	0.77	1.07	6.3	0.95	2.3
10	0.89	1.17	0.96	2.50	1.03	4.7	.....	.....
11	0.89	1.17	0.96	2.50	1.10	7.6	.....	.....
12	0.89	1.17	0.97	2.80	1.16	11.3	.....	.....
13	0.87	0.90	0.96	2.50	1.12	8.8	.....	.....
14	0.89	1.17	0.97	2.80	1.12	8.8	.....	.....
15	0.90	1.30	0.97	2.80	1.12	8.8	.....	.....
16	0.90	1.30	0.97	2.80	1.11	8.2	.....	.....
17	0.89	1.17	0.97	2.80	1.09	7.2	.....	.....
18	0.90	1.30	0.96	2.50	1.07	6.3	.....	.....
19	0.87	0.90	0.96	2.50	1.05	5.4	.....	.....
20	0.86	0.77	0.96	2.50	1.03	4.7	.....	.....
21	0.87	0.90	0.98	3.10	1.03	4.7	.....	.....
22	0.86	0.77	0.98	3.10	1.03	4.7	.....	.....
23	0.86	0.77	0.98	3.10	1.01	4.0	.....	.....
24	0.89	1.17	0.98	3.10	1.01	4.0	.....	.....
25	0.88	1.04	0.98	3.10	0.97	2.8	.....	.....
26	0.87	0.90	0.98	3.10	0.97	2.8	.....	.....
27	0.89	1.17	1.00	3.60	0.96	2.5	.....	.....
28	0.89	1.17	1.20	14.10	0.96	2.5	.....	.....
29	0.89	1.17	1.20	14.10	0.95	2.3	.....	.....
30	0.86	0.77	1.20	14.10	0.95	2.3	.....	.....
31	0.86	0.77	.....	.....	0.95	2.3	.....	.....

MONTHLY DISCHARGE of Sucker creek at Gilchrist's ranch, for 1916

(Drainage area 30 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
April	28.0	5.80	13.30	0.443	0.49	791
May	78.0	3.10	18.10	0.603	0.70	1,113
June	78.0	0.77	23.00	0.767	0.86	1,369
July	62.0	2.30	6.80	0.227	0.26	418
August	3.6	0.77	1.35	0.045	0.05	83
September	14.1	0.77	3.50	0.117	0.13	205
October	46.0	2.30	8.20	0.273	0.31	504
November (1-9)	2.3	2.10	2.20	0.073	0.02	39
The period	.....	.....	.....	.....	2.82	4,522

MEAN MONTHLY DISCHARGE in Second-feet of Sucker creek at Gilchrist's ranch

MONTH	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	2.50	2.30	3.00	3.50	2.20	3.0	4.30	8.2	3.60	222
November	.....	.....	.....	3.00*d*	3.40*e*	.....	.....	.....	2.2*h*	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
March	.....	.....	16.40*c*	.....	.....	13.80*f*	6.0*g*	.....	.....	.....	.....
April	.....	5.20	26.00	107.00	52.00	24.00	16.7	13.30	.....	35.00	2,081
May	6.30*a*	2.50	5.80	11.50	7.40	5.10	6.1	18.10	.....	8.10	497
June	14.20*b*	1.40	3.70	3.20	2.80	2.30	5.1	23.00	.....	5.90	353
July	11.50	0.73	1.40	2.10	1.89	0.36	3.8	6.80	.....	3.60	219
August	1.25	1.58	1.40	2.50	1.36	0.35	2.8	1.35	.....	1.57	97
September	2.03	2.10	3.90	3.20	1.57	1.17	4.1	3.50	.....	2.70	160
Total in acre-ft.	1,780	970	2,789	7,979	4,351	2,584	2,613	4,243	.....	.....	3,629

a 25-31.
b 1-19—22-30.
c 26-31.
d 1.
e 1-15.
f 15-31.
g 23-31.
h 1-9.
This station was originally at Whitcomb and Zeigler's ranch.

FRENCHMAN RIVER NEAR BELANGER

Location.—On the SE. ¼ Sec. 19, Tp. 6, Rge. 25, W. 3rd Mer., near Belanger post office.

Records available.—From June 12 to October 31, 1916.

Gauge.—Vertical enamel staff on left bank; zero elevation of gauge 3,150.90 feet above sea-level.

Bench-mark.—Wooden plug in ground about 50 feet from gauge on left bank; elevation of bench-mark 3,154.60 feet above sea-level (Canadian Irrigation Surveys).

Channel.—Gravel, likely to shift in high water.

Discharge measurements.—By wading with current-meter, or with weir. During high water at bridge three-quarter mile up stream.

Winter flow.—Observations discontinued during winter months.

Observer.—Jos. Drury.

DISCHARGE MEASUREMENTS of Frenchman river near Belanger, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
May 11	J. E. Caughey	9.0	5.20	1.96	.....*x*	10.2
June 10	do	11.0	9.65	1.30	.....*x*	12.5
July 12	do	13.0	10.10	0.79	1.27	8.0
Sept. 2	L. B. P. Miles	12.6	5.90	0.59	0.85	3.5
Oct. 24	do	10.0	3.35	1.41	0.48	4.7

x No gauge.

Daily Gauge Height and Discharge of Frenchman river near Belanger, for 1916

Day	June		July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	2.17	22.0	1.25	7.7	0.95	4.5	1.26	7.8
2	.....	.....	2.12	21.0	1.20	7.1	0.85	3.6	1.29	8.2
3	.....	.....	2.07	20.0	1.20	7.1	0.85	3.6	1.32	8.5
4	.....	.....	2.07	20.0	1.18	6.9	0.86	3.7	1.25	7.8
5	.....	.....	1.99	18.9	1.18	6.9	0.86	3.7	1.20	7.3
6	.....	.....	1.97	18.6	1.17	6.7	0.89	3.9	1.25	7.8
7	.....	.....	1.88	16.9	1.17	6.7	0.90	4.0	1.30	8.3
8	.....	.....	1.67	13.5	1.19	7.0	0.93	4.3	1.30	8.3
9	.....	.....	1.62	12.7	1.24	7.6	0.95	4.5	1.27	8.0
10	.....	.....	1.57	12.0	1.23	7.5	0.90	4.0	1.24	7.7
11	.....	.....	1.37	9.2	1.20	7.1	0.85	3.6	1.19	7.2
12	3.82	59	1.27	7.9	1.19	7.0	0.84	3.5	1.15	6.9
13	3.83	60	1.26	7.8	1.17	6.7	0.84	3.5	1.10	6.6
14	3.25	46	1.26	7.8	1.16	6.6	0.83	3.4	1.06	6.4
15	3.17	44	1.26	7.8	1.16	6.6	0.83	3.4	1.03	6.2
16	3.17	44	1.25	7.7	.....	6.6*e*	0.83	3.4	1.00	6.0
17	3.02	41	1.25	7.7	1.16	6.6	0.80	3.2	0.99	6.0
18	2.97	39	2.00	19.1	1.15	6.5	0.80	3.2	0.90	5.6
19	2.87	37	2.10	21.0	1.15	6.5	0.79	3.1	0.80	5.2
20	2.37	26	2.00	19.1	1.15	6.5	0.78	3.0	0.80	5.2
21	2.22	23	1.70	14.0	1.14	6.4	0.78	3.0	0.70	5.0
22	2.37	26	1.70	14.0	1.13	6.3	0.77	3.0	0.60	4.8
23	2.49	28	1.40	9.6	1.13	6.3	0.77	3.0	0.50	4.6
24	2.27	24	1.40	9.6	1.12	6.2	0.76	2.9	0.48	4.6
25	2.22	23	1.30	8.3	1.11	6.1	0.80	3.2	0.48	4.6
26	2.21	23	1.30	8.3	1.10	6.0	1.22	7.3	0.48	4.6
27	2.22	23	1.30	8.3	1.10	6.0	1.25	7.7	0.47	4.5
28	2.17	22	1.45	10.3	1.09	5.9	1.25	7.7	0.47	4.5
29	2.18	22	1.35	8.9	1.09	5.9	1.24	7.6	0.46	4.5
30	2.19	22	1.30	8.3	1.08	5.8	1.20	7.1	0.45	4.5
31	.....	.....	1.25	7.7	1.08	5.8	.....	.....	0.45	4.5

e Discharge estimated.

Monthly Discharge of Frenchman river near Belanger, for 1916

(Drainage area 174 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
June (12-30)	60.0	22.0	33.0	0.190	0.13	1,243
July	22.0	7.7	12.8	0.074	0.09	787
August	7.7	5.8	6.6	0.038	0.04	406
September	7.7	2.9	4.2	0.024	0.03	250
October	8.5	4.5	6.2	0.036	0.04	381
The period	.....	.....	.....	.....	0.33	3,067

BELANGER CREEK AT OAKES' RANCH

Location.—On the NE. ¼ Sec. 19, Tp. 6, Rge. 25, W. 3rd Mer. Previous to August 7, 1915, was a mile up stream on the SW. ¼ Sec. 30, Tp. 6, Rge. 25, W. 3rd Mer.

Records available.—April 1, 1912, to April 11, 1914, and June 17, 1915, to October 31, 1916.

Gauge.—Vertical staff. The zero elevation of the gauge was maintained at 3,164.10 feet from date of establishment until August 7, 1915; from August 7, 1915, until October 31, 1916, it was maintained at 3,447.71 feet. (This elevation was incorrectly reported in 1915 report.)

Bench-mark.—Permanent iron bench-mark; elevation 3,168.37 feet above mean sea-level. (Irrigation Survey).

Channel.—Slightly shifting, affected by weeds.

Discharge measurements.—Made with current-meter.

Winter flow.—This station is not maintained during the winter.

Diversions.—R. H. Williamson, T. A. Drury, J. H. G. Bettington and Messrs. Dixon and Stewart divert water for irrigation purposes above the gauge.

Observer.—Joseph Drury.

Note.—Gauge heights from February 20 to March 31, 1916, are unreliable and not published.

DISCHARGE MEASUREMENTS of Belanger creek at Oakes' ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 6	M. H. French	10.0	14.0	0.66	4.69	9.2
May 11	J. E. Caughey	10.0	16.4	0.67	3.37	11.0
June 12	do	62.0	115.6	1.49	7.50	172.0
July 12	do	11.0	21.6	0.58	3.87	12.6
Sept. 2	L. B. P. Miles	6.5	16.1	0.54	1.69	8.7
Oct. 21	do	9.0	19.4	0.67	3.48	13.0

DAILY GAUGE HEIGHT AND DISCHARGE of Belanger creek at Oakes' ranch, for 1916

DAY	April		May		June		July	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	5.14	10.0*e*	.....*x*	.....	5.30	26.0	4.00	13.3
2	4.73	9.0*e*	.....	.....	5.00	22.0	4.00	13.3
3	3.23	8.0*e*	.....	.....	4.10	13.9	4.30	15.3
4	4.68	9.2*e*	.....	.....	4.10	13.9	4.60	17.9
5	.....	9.2*e*	.....	.....	4.90	21.0	4.50	16.9
6	4.68	9.2*d*	.....	.....	4.80	20.0	4.47	16.6
7	4.13	14.1	.....	.....	4.58	17.1	4.40	16.0
8	4.70	19.0	.....	.....	4.30	15.3	4.30	15.3
9	4.68	18.8	.....	.....	.....	15.0*e*	4.31	15.4
10	4.58	17.7	.....*x*	.....	4.20	14.6	4.31	15.4
11	4.23	14.8	3.37	10.6	5.90	32.0	4.31	15.4
12	4.13	14.1	.....	10.5*e*	7.50	50.0	3.87	12.6
13	4.08	13.8	.....	10.5*e*	6.49	39.0	3.85	12.6
14	4.03	13.5	3.27	10.4	5.00	22.0	3.80	12.3
15	4.18	14.5	3.30	10.5	4.95	22.0	3.80	12.3
16	4.13	14.1	3.30	10.5	4.90	21.0	3.80	12.3
17	4.08	13.8	3.30	10.5	4.85	21.0	4.20	14.6
18	4.06	13.7	3.50	11.0	4.70	19.0	4.45	16.4
19	4.07	13.7	3.56	11.2	4.68	18.8	4.35	15.6
20	4.05	13.6	4.00	13.3	4.68	18.8	4.35	15.6
21	4.02	13.4	4.31	15.4	5.00	22.0	4.35	15.6
22	3.98	13.2	4.31	15.4	5.10	23.0	4.35	15.6
23	4.58	17.7	4.51	17.0	5.20	24.0	4.32	15.4
24	4.68	18.8	4.60	17.9	5.00	22.0	4.30	15.3
25	4.98	22.0	4.90	21.0	4.90	21.0	4.25	15.0
26	5.08	23.0	5.00	22.0	4.90	21.0	4.25	15.0
27	5.78	31.0	5.70	30.0	4.89	21.0	5.90	32.0
28	6.13	35.0	6.05	34.0	4.91	21.0	5.95	33.0
29	6.12	35.0	6.07	34.0	4.00	13.3	5.85	32.0
30	.....	.....	5.85	32.0	4.30	15.3	4.98	22.0
31	.....	.....	5.00	22.0	.....	.....	4.90	21.0

Observer's records, prior to April 1, unreliable; not published.
d Actual measurement.
e Discharge estimated.
x-x No gauge heights available.

DAILY GAUGE HEIGHT AND DISCHARGE of Belanger creek at Oakes' ranch, for 1916—*Concluded*

DAY	August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.80	20.0	3.94	13.0	3.75	12.0
2	4.75	19.6	1.69	8.5	3.95	13.0
3	4.69	18.9	1.70	8.5	4.00	13.3
4	4.60	17.9	1.70	8.5	3.90	12.8
5	4.54	17.3	1.80	8.5	3.81	12.2
6	4.49	16.8	1.80	8.5	3.91	12.8
7	4.45	16.4	1.80	8.5	3.96	13.1
8	4.45	16.4	1.85	8.6	4.11	14.0
9	4.49	16.8	1.87	8.6	4.11	14.0
10	4.50	16.9	1.85	8.6	4.08	13.8
11	4.48	16.7	1.85	8.6	4.04	13.5
12	4.47	16.6	1.85	8.6	4.01	13.4
13	4.46	16.5	1.84	8.5	3.96	13.1
14	4.46	16.5	1.82	8.5	3.93	13.0
15	4.44	16.4	1.80	8.5	3.88	12.7
16	4.44	16.4	1.80	8.5	3.88	12.7
17	4.40	16.0	3.60	11.4	3.87	12.6
18	4.35	15.6	3.65	11.6	3.87	12.6
19	4.35	15.6	3.65	11.6	3.87	12.6
20	4.30	15.3	3.69	11.8	3.87	12.6
21	4.20	14.6	3.70	11.8	3.48	10.9
22	4.15	14.2	3.70	11.8	3.48	10.9
23	4.13	14.1	3.72	12.2	3.48	10.9
24	4.07	13.7	3.73	12.0	3.48	10.9
25	4.00	13.3	3.75	12.0	3.48	10.9
26	3.95	13.0	4.20	14.6	3.45	10.8
27	3.95	13.0	4.00	13.3	3.43	10.8
28	3.94	13.0	3.90	12.8	3.40	10.7
29	3.94	13.0	3.80	12.3	3.35	10.6
30	3.94	13.0	3.75	12.0	3.33	10.6
31	3.95	13.0	.....	.....	3.32	10.5

MONTHLY DISCHARGE of Belanger creek at Oakes' ranch, for 1916

(Drainage area 65 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
April	35.0	8.0	16.3	0.251	0.28	938
May (11-31)	34.0	10.4	17.6	0.271	0.31	733
June	50.0	13.3	22.0	0.388	0.38	1,309
July	33.0	12.3	17.0	0.262	0.30	1,045
August	20.0	13.0	15.7	0.242	0.28	965
September	14.6	8.5	10.4	0.160	0.18	619
October	14.0	10.5	12.2	0.188	0.22	750
The period	.....	.....	.....	.....	1.95	6,359

MEAN MONTHLY DISCHARGE in Second-feet of Belanger creek at Oakes' ranch

MONTH	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	4.60	1.16	2.80	10.8*k*	3.4	.....	6.9	12.2	5.2	318
November	.....	.....	.....	1.10*e*	8.8*l*	.....	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
March	.....	.....	26.00*b*	.....	.....	.....	.....	.....	.....	.....	.....
April	.....	6.30	17.20*c*	113.0	73.0	..... *m*	.....	16.3	.....	52.0	3,104
May	.....	5.70	.....	22.0*f*	9.9	.....	.....	17.6*p*	.....	7.8	480
June	47.0*a*	5.50	.....	8.2*g*	7.2	.....	16.8*n*	22.0	.....	11.6	688
July	22.0	2.20	.....	8.5	6.0	.....	21.0	17.0	.....	12.8	787
August	6.3	1.91	2.90*d*	.....	4.3	.....	6.9	15.7	.....	7.0	431
September	4.2	1.35	2.50	10.3*h*	3.1	.....	7.1	10.4	.....	4.8	284
Total in acre-ft.	3,666	1,666	1,752	8,569	6,670	208	2,589	6,033	.....	.....	6,092

a 12-20; 22-30.
b 15-31.
c 1-6.
d 13-31.
e 1-19.
f 1-16.
g 13 and 18-30
h Partial month.
k do do
l 1-15.
m No observer after April 11; insufficient records to compute discharge.
n 17-30.
p 11-31.

Prior to 1912 records taken at Garrison's ranch, Sec. 18, Tp. 7, Rge. 25, W. 3rd Mer. Drainage area 43 square miles.

DAVIS CREEK AT DRURY'S RANCH

Location.—On the NE. ¼ Sec. 29, Tp. 6, Rge. 25, W. 3rd Mer.

Records available.—May 24 to November 3, 1909, and April 23, 1911, to October 31, 1916.

Gauge.—Vertical staff; zero elevation has been maintained at 3,176.79 feet since establishment.

Bench-mark.—Permanent iron bench-mark; elevation 3,183.06 feet above mean sea-level. (Irrigation Surveys.)

Channel.—Permanent.

Discharge measurements.—Made by wading with current-meter, or by weir at low stages.

Winter flow.—This station is not maintained during the winter.

Observer.—Joseph Drury.

DISCHARGE MEASUREMENTS of Davis creek at Drury's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 28	M. H. French	25.0	21.20	3.24	1.10	68.0
April 5	do	16.0	11.40	2.46	0.67	28.0
May 11	J. E. Caughey	10.7	4.55	1.80	0.39	8.2
June 9	do	10.0	5.80	2.50	0.48	14.5
June 11	do	35.0	54.80	3.41	2.53	187.0
July 11	do	7.2	3.13	1.33	0.25	4.2
July 27	do	30.0	45.90	2.85	1.73	131.0
Sept. 2	L. B. P. Miles	11.0	2.94	0.80	0.23	2.4
Oct. 21	do	13.4	5.92	1.77	0.42	10.5

DAILY GAUGE HEIGHT AND DISCHARGE of Davis creek at Drury's ranch, for 1916

DAY	February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	2.15	173.0	0.76	36.0	0.50	15.4	0.88	46.0
2	.....	.....	2.10	168.0	0.66	27.0	0.50	15.4	0.81	40.0
3	.....	.....	1.01	59.0	0.61	23.0	0.47	13.6	0.72	32.0
4	.....	.....	0.95	53.0	0.58	21.0	0.47	13.6	0.63	25.0
5	.....	.....	0.85	43.0	0.58	21.0	0.46	13.0	.....	122.0
6	.....	.....	0.80	39.0	0.58	21.0	0.46	13.0	1.50	108.0
7	.....	.....	0.75	35.0	0.56	19.6	0.44	11.8	0.87	45.0
8	.....	.....	0.69	30.0	0.56	19.6	0.43	11.3	0.69	30.0
9	.....	.....	0.49	14.8	0.76	36.0	0.42	10.7	0.48	14.2
10	.....	.....	0.47	13.6	0.90	48.0	0.42	10.7	0.60	23.0
11	.....	.....	0.49	14.8	0.74	34.0	0.39	9.1	2.30	164.0*s*
12	.....	.....	0.50	15.4	0.67	28.0	0.39	9.1	1.59	95.0
13	.....	.....	.....	184.0*e*	0.70	31.0	0.41	10.2	1.58	96.0
14	.....	.....	3.95	353.0	0.66	27.0	0.40	9.6	0.86	29.0
15	.....	.....	2.70	228.0	0.73	33.0	0.40	9.6	0.55	9.1
16	.....	.....	1.45	103.0	0.73	33.0	0.40	9.6	0.54	9.6
17	.....	.....	0.63	25.0	0.77	36.0	0.40	9.6	0.48	7.7
18	2.50	209	0.69	30.0	0.94	52.0	0.39	9.1	0.46	7.7
19	2.51	209	0.63	25.0	0.70	31.0	0.37	8.2	0.44	7.7
20	2.54	212	1.00	58.0	0.64	26.0	0.35	7.4	0.42	7.7
21	2.49	207	2.97	255.0	0.58	21.0	0.35	7.2	0.35	5.4
22	2.48	206	4.35	393.0	0.55	18.8	0.35	7.2	0.68	27.0*s*
23	2.45	203	2.13	171.0	0.56	19.6	0.39	9.1	1.50	108.0
24	2.43	201	1.37	95.0	0.55	18.8	0.45	12.4	1.28	86.0
25	2.39	197	1.55	113.0	0.54	18.1	1.06	64.0	1.15	73.0
26	2.35	193	1.30	88.0	0.52	16.8	1.06	64.0	0.98	56.0
27	2.29	187	1.57	115.0	0.52	16.8	1.95	153.0	0.94	52.0
28	2.25	183	1.33	91.0	0.52	16.8	2.10	168.0	0.88	46.0
29	2.20	178	0.87	45.0	0.52	16.8	1.90	148.0	0.73	33.0
30	.....	.....	0.89	47.0	0.50	15.4	1.76	134.0	0.75	35.0
31	.....	.....	0.77	36.0	.....	.....	0.94	52.0	.....	.....

s-s Shifting conditions.
e Discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of Davis creek at Drury's ranch, for 1916—*Concluded*

Day	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	0.70	31.00	1.79	137.0	0.22	2 6	0.39	9.1
2	0.65	26 00	1.01	59.0	0 22	2 6	0.44	11.8
3	0.58	21.00	0.94	52.0	0.23	2 8	0.44	11.8
4	0.94	52.00	0 74	34.0	0.23	2 8	0.42	10.7
5	0.85	43.00	0.52	16.8	0.23	2.8	0.39	9.1
6	0.74	34.00	0.40	9.6	0 29	4.7	0.44	11.8
7	0.60	23 00	0 38	8.6	0.33	6.3	0.54	18.1
8	0.48	14 20	0.36	7.7	0 29	4.7	0.69	30.0
9	0.35	7 20	0.38	8.6	0.30	5.0	0.64	26.0
10	0.30	5.00	0.38	8.6	0.29	4.7	0.62	24.0
11	0.28	4.40	0.38	8.6	0.29	4.7	0.60	23.0
12	0 22	2.60	0.36	7.7	0.28	4.4	0.54	18.1
13	0.20	2.00	0.34	6.8	0.28	4.4	0.52	16.8
14	0.20	2 00	0.33	6.3	0.26	3.7	0 49	14.8
15	0.20	2.00	0.31	5.4	0.24	3.1	0.46	13.0
16	0.19	1.76	0.29	4.7	0.24	3.1	0.44	11.8
17	0 20	2.00	0 27	4.0	0.24	3.1	0 44	11.8
18	0.25	3.40	0 25	3.4	0.24	3.1	0.44	11.8
19	0.27	4.00	0 25	3.4	0.24	3.1	0 44	11.8
20	.....	.....	0.25	3.4	0.24	3.1	0.44	11.8
21	.....	.....	0.24	3.1	0.24	3.1	0.42	10.7
22	.....	.....	0 24	3.1	0.23	2 8	0.42	10.7
23	.....	.....	0 24	3.1	0.23	2 8	0.42	10.7
24	.....	.....	0 23	2 8	0.23	2 8	0.42	10.7
25	.....	.....	0.23	2.8	0.24	3.1	0.41	10.2
26	.....	.....	0.23	2.8	0.42	10.7	0.41	10.2
27	.....	.....	0 23	2 8	0.44	11 8	0.41	10.2
28	.....	.....	0.22	2 6	0.44	11.8	0.39	9.1
29	.....	.....	0.22	2.6	0.42	10.7	0.39	9.1
30	.....	.....	0.22	2.6	0.41	10.2	0.39	9.1
31	.....	.....	0.22	2.6	.....	.....	0.38	8.6

Observer's records, July 20-31, unreliable; not published.

MONTHLY DISCHARGE of Davis creek at Drury's ranch, for 1916

(Drainage area 45 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
February (18-29)	212.0	178.00	199.0	4.420	0.197	4,735
March	393.0	13.60	100.0	2.220	2.560	6,149
April	52.0	15.40	26.0	0.578	0.645	1,547
May	168.0	7.20	34.0	0.756	0.872	2,090
June	164.0	5.40	48.0	1.070	1.190	2,856
July (1-19)	52.0	1.76	14.8	0.328	0.232	558
August	137.0	2.60	13.7	0 304	0.350	842
September	11.8	2.60	4.8	0.107	0.119	286
October	30.0	8.60	13.2	0.294	0.339	812
The period	.....	.....	.....	.....	6.504	19,875

MEAN MONTHLY DISCHARGE in Second-feet of Davis creek at Drury's ranch

MONTH	1908-9	1909-10	1910-11	1911-12	1912-13	1913-14	1914-15	1915-16	1916-17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	0.60	.....	5.40*g*	1.90	0.07	...*m*	2.70	13.2	3.7	227
November	.....	1.65*c*	.....	.....	2.80*h*	.....	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	.....	.....	199.0*o*	.....	.....	.....
March	.....	.....	.....	.....	.....	22.00*k*	9.00*n*	100.0	.....	100.0	6,149
April	.....	.....	58.00*d*	143.00	77.00	44.00	58.00	26.0	.....	51.0	3,049
May	20.00*a*	.....	12.90	27.00	8.00	7.20	6.80	34.0	.....	16.0	979
June	14.80*b*	.....	4 50	7.00	2.80	1.97	16.80	48.0	.....	13.5	788
July	19.40	.....	19 20*e*	1.66	2.90	1.85	14.50	14.8*p*	.....	8.1	495
August	2.00	.....	0.70*f*	1.41	1.55	0.20*l*	2.50	13.7	.....	4.2	260
September	1.23	.....	5.10	0.74	0.22	.....*m*	1.23	4.8	.....	2.2	132
Total in acre-ft.	2,503	47	2,497	10,945	5,755	4,156	6,149	19,229	.....	.....	12,079

a 24-31.
b 1-19 and 23-30.
c 1-3.
d 23-30.
e 1-4 and 13.
f 15-31.
g 1-16.
h 1-15.
k 10-31.
l 22-31.
m No observer.
n 23-31.
o 18-29.
p 1-19.

FAIRWELL CREEK AT DRURY'S RANCH

Location.—On the NW. ¼ Sec. 30, Tp. 6, Rge. 24, W. 3rd Mer.

Records available.—June 10, 1909, to October 31, 1916.

Gauge.—Vertical staff; zero elevation has been maintained at 3,122.77 feet since establishment.

Bench-mark.—Permanent iron bench-mark; elevation 3,127.64 feet above sea-level (Irrigation Surveys datum).

Channel.—Slightly shifting, owing to beaver dams.

Discharge measurements.—Made with current-meter, and weir at low stages.

Diversions.—Messrs. Armstrong & Sons, Kearney Bros. and J. Ingram divert water for irrigation purposes above this gauge.

Observer.—C. A. Drury.

DISCHARGE MEASUREMENTS of Fairwell creek at Drury's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec*	*Feet*	*Sec.-ft.*
Mar. 27	M. H. French	100.0	127.00	2.54	3.73	323.0
April 5	do	14.0	12.40	2.67	2.68	33.0
May 11	J. E. Caughey	15.0	9.35	2.35	2.39	22.0
June 9	do	14.0	11.60	2.58	2.52	30.0
June 13	do	22.0	27.90	3.20	2.85	89.0
July 11	do	13.5	7.23	2.06	2.30	14.9
July 26	do	13.8	7.39	1.76	2.33	13.0
Sept. 1	L. P. B. Miles	13.5	4.55	1.55	2.15	7.1
Oct. 13	do	13.8	13.10	1.91	2.48	25.0*x*

x Beavers diverting water above the gauge.

DAILY GAUGE HEIGHT AND DISCHARGE of Fairwell creek at Drury's ranch, for 1916

DAY	February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	2.59	.....	3.25	195	2.55	33.0	2.73	61.0
2	.....	.....	2.54	.....	3.15	168	2.53	31.0	2.65	47.0
3	.....	.....	2.44	.....	3.05	142	2.55	33.0	2.63	44.0
4	.....	.....	2.44	.....	2.95	115	2.55	33.0	2.59	38.0
5	.....	.....	2.39	.....	2.90	102	2.55	33.0	2.59	38.0
6	.....	.....	2.39	.....	2.85	89	2.53	31.0	3.00	128.0
7	.....	.....	2.34	.....	2.85	89	2.52	30.0	2.75	65.0
8	.....	.....	2.34	.....	2.85	89	2.50	28.0	2.60	39.0
9	.....	.....	2.34	.....	2.95	115	2.45	24.0	2.50	28.0
10	.....	.....	2.29	.....	3.05	142	2.40	19.8	2.55	33.0
11	.....	.....	3.39	.....	3.20	182	2.40	19.8	2.95	115.0
12	.....	.....	4.39	.....	3.10	155	2.40	19.8	3.00	128.0
13	.....	.....	4.14	.....	3.00	128	2.35	16.8	2.80	76.0
14	.....	.....	3.49	.....	3.00	128	2.35	16.8	2.65	47.0
15	.....	.....	3.57	.....	3.00	128	2.35	16.8	2.56	34.0
16	.....	.....	3.47	.....	2.95	115	2.40	19.8	2.48	26.0
17	.....	.....	3.32	.....	2.80	76	2.38	18.6	2.44	23.0
18	.....	.....	3.07	.....	2.90	102	2.42	21.0	2.40	19.8
19	.....	.....	3.11	.....	2.90	102	2.40	19.8	2.38	18.6
20	2.68	.....	3.21	.....	2.85	89	2.35	16.8	2.35	16.8
21	3.22	.....	4.47	.....	2.80	76	2.35	16.8	2.33	15.6
22	3.30	.....	4.49	.....	2.75	65	2.34	16.2	2.45	24.0
23	3.30	.....	3.74	.....	2.70	55	2.34	16.2	2.95	115.0
24	3.19	.....	3.39	.....	2.69	53	2.38	18.6	2.80	76.0
25	3.07	.....	3.21	.....	2.67	50	2.80	76.0	2.65	47.0
26	2.97	.....	3.14	.....	2.65	47	2.99	126.0	2.53	31.0
27	2.89	.....	3.73	323*d*	2.61	41	3.20	182.0	2.40	19.8
28	2.77	.....	3.70	314	2.57	36	3.20	182.0	2.39	19.2
29	2.69	.....	3.50	261	2.55	33	3.15	168.0	2.44	23.0
30	.....	.....	3.40	235	2.55	33	3.10	155.0	2.65	47.0
31	.....	.....	3.30	208	.....	.....	2.85	89.0	.....	.....

Discharge affected by ice, February 20 to March 26; gauge heights only published.
d Actual measurement.

DAILY GAUGE HEIGHT AND DISCHARGE of Fairwell creek at Drury's ranch, for 1916.—*Concluded.*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.65	47.0	2.40	19.8	2.15	7.2	2.05	4.0
2	2.60	39.0	2.36	17.4	2.15	7.2	2.10	5.4
3	2.70	55.0	2.33	15.6	2.15	7.2	2.10	5.4
4	2.65	47.0	2.29	13.3	2.18	8.3	2.15	7.2
5	2.47	25.0	2.27	12.4	2.15	7.2	2.16	7.6
6	2.40	19.8	2.25	11.4	2.15	7.2	2.21	9.5
7	2.36	17.4	2.23	10.4	2.15	7.2	2.36	17.4
8	2.35	16.8	2.22	10.0	2.14	6.8	2.41	21.0
9	2.34	16.2	2.35	16.8	2.14	6.8	2.41	21.0
10	2.36	17.4	2.55	33.0	2.14	6.8	2.44	23.0
11	2.34	16.2	2.45	24.0	2.13	6.5	2.46	24.0
12	2.30	13.8	2.35	16.8	2.13	6.5	2.46	24.0
13	2.27	12.4	2.30	13.8	2.12	6.1	2.48	26.0
14	2.26	11.9	2.25	11.4	2.12	6.1	2.48	26.0
15	2.25	11.4	2.23	10.4	2.10	5.4	2.44	23.0
16	2.26	11.9	2.23	10.4	2.10	5.4	2.44	23.0
17	2.24	10.9	2.22	10.0	2.10	5.4	2.43	22.0
18	2.25	11.4	2.22	10.0	2.10	5.4	2.41	21.0
19	2.25	11.4	2.22	10.0	2.09	5.1	2.37	18.0
20	2.24	10.9	2.22	10.0	2.09	5.1	2.35	16.8
21	2.22	10.0	2.21	9.5	2.08	4.8*x*	2.35	16.8
22	2.20	9.0	2.21	9.5	2.07	4.6	2.35	16.8
23	2.19	8.6	2.21	9.5	2.05	4.0	2.35	16.8
24	2.18	8.3	2.21	9.5	2.05	4.0	2.35	16.8
25	2.18	8.3	2.21	9.5	2.06	4.3	2.33	15.6
26	2.33	15.6	2.20	9.0	2.09	5.1	2.33	15.6
27	3.00	128.0	2.19	8.6	2.10	5.4	2.31	14.4
28	2.80	76.0	2.18	8.3	2.08	4.8	2.26	11.9
29	2.68	51.0	2.18	8.3	2.06	4.3	2.26	11.9
30	2.50	28.0	2.17	7.9	2.05	4.0	2.23	10.4
31	2.45	24.0	2.16	7.6	.....	.....	2.23	10.4

x Beavers diverting water above the gauge.
Small flow continued for period in November.

MONTHLY DISCHARGE of Fairwell creek at Drury's ranch, for 1916

(Drainage area 125 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (27-31)	323.0	208.0	268.0	2.140	0.40	2,657
April	195.0	33.0	98.0	0.784	0.87	5,831
May	182.0	16.2	49.0	0.392	0.45	3,013
June	128.0	15.6	48.0	0.384	0.43	2,856
July	128.0	8.3	25.0	0.200	0.23	1,537
August	33.0	7.6	12.4	0.099	0.11	762
September	8.3	4.0	5.8	0.046	0.05	345
October	26.0	4.0	16.2	0.130	0.15	996
The period	.....	.....	.....	.....	2.69	17,997

MEAN MONTHLY DISCHARGE in Second-feet of Fairwell creek at Drury's ranch

MONTH	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	3.40	0.96	8.4*e*	3.9	1.08	1.08	3.40	16.2	4.3	264
Nov....	.....	.....	.....	.....	12.2*g*	.....	.....	.....	.....	.....	.....
Dec....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
March..	.....	.....	166.00*c*	.....	.....	34.00*h*	1.53*k*	268.0*l*	.....	.....	.....
April...	.....	18.30*b*	129 00	313.0*f*	122 0	102.00	65.00	98.0	.....	103.0	6,135
May....	.....	13.00	24.00*d*	17 2	14.4	14 20	14 70	49.0	.....	20.0	1,255
June....	87.0*a*	5.00	10.90	8.0	7 2	6.60	64.00	48.0	.....	21.0	1,273
July....	44 0	2.70	8.40	5.3	5.7	2.60	15.90	25.0	.....	13.7	842
August .	7.3	2.60	3.70	4.9	3.8	1.21	8 90	12 4	.....	5.6	345
Sept.....	4.6	1.59	2.90	4.1	2.9	1.22	4.50	5 8	.....	3.5	206
Total in Acre-ft.	1,033	2,168	13,833	16,529	9,918	9,334	10,463	17,210	.....	.....	10,320

a 10-30
b 19-30.
c 9-30.
d 1-15.
e 8-31.
f 20-31.
g 1-10 and 17-18.
h 1-28.
k 24-31.
l 27-31.

A. M. CROSS DITCH FROM CALF CREEK

Location.—On SE. ¼ Sec. 5, Tp. 8, Rge. 22, W. 3rd Mer.

Records available.—June 1, 1914, to close of irrigation season 1916.

Gauge.—Vertical staff located about forty feet from the intake of the ditch. Elevation of the zero of the gauge referred to P.I.B.M. has been maintained at 96.36 feet since establishment.

Bench-mark.—Permanent iron, set July 29, 1915; assumed elevation 100.00 feet.

Channel.—Slightly shifting, owing to growth of weeds.

Discharge measurements.—Made with current-meter.

Observer.—A. M. Cross.

Remarks.—No water used during irrigation season of 1916.

F. CROSS DITCH FROM NORTH BRANCH OF FRENCHMAN RIVER

Location.—On NW. ¼ Sec. 15, Tp. 7, Rge. 22, W. 3rd Mer., about 130 feet from the intake of the ditch.

Records available.—During irrigation season, 1912 to 1916.

Gauge.—Staff fastened to the left side of the flume; elevation of zero maintained at 94.45 feet from establishment to July 27, 1915, and at elevation 96.63 feet since that date.

Bench-mark.—On July 27, 1915, a permanent iron bench-mark was set on the right bank about 10 feet north of the gauge; the assumed elevation is 100.00 feet.

Discharge measurements.—Made by current-meter at the section, or by a weir in the ditch.

Observer.—Frank Cross.

DAILY GAUGE HEIGHT AND DISCHARGE of F. Cross ditch from North branch of Frenchman river, for 1916

MAY			JUNE			JUNE			JULY		
Day	Gauge Height	Discharge	Day	Gauge Height	Discharge	Day	Gauge Height	Discharge	Day	Gauge Height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*
21	1.46*h*	.....	4	1.42	.....	18	1.42	.....	1	1.33	.....
22	1.46	.....	5	1.50	.....	19	1.42	.....	2	1.25	.....
23	1.50	.....	6	1.46	.....	20	1.42	.....	.....	.....	.....
24	1.50*h*	.....	7	1.42	.....	21	1.33	.....	.....	.....	.....
.....	.....	.....	8	1.35	4.1*d*	22	1.50	.....	.....	.....	.....
.....	.....	.....	9	1.42	.....	23	1.54	.....	.....	.....	.....
.....	.....	.....	10	1.50	.....	24	1.42	.....	.....	.....	.....
.....	.....	.....	11	1.50*h*	.....	25	1.38	.....	.....	.....	.....
.....	.....	.....	12	.....	.....	26	1.29	.....	.....	.....	.....
.....	.....	.....	13	.....	.....	27	1.29	.....	.....	.....	.....
.....	.....	.....	14	1.42*h*	.....	28	1.25	.....	.....	.....	.....
.....	.....	.....	15	1.42	.....	29	1.33	.....	.....	.....	.....
.....	.....	.....	16	1.42	.....	30	1.42	.....	.....	.....	.....
.....	.....	.....	17	1.42	.....	.....	.....	.....	.....	.....	.....

h Headgate opened May 21, closed May 24; opened June 4, closed June 11; opened June 14, closed July 2.
d Actual measurement; no others taken during season; therefore unable to plot curve and compute daily discharge.

NORTH BRANCH OF FRENCHMAN RIVER AT F. CROSS' RANCH

Location.—On the NE. ¼ Sec. 16, Tp. 7, Rge. 22, W. 3rd Mer., at F. Cross' ranch near East End.

Records available.—August 1, 1908, to October 31, 1916.

Gauge.—Vertical staff. The elevation of zero maintained at 91.28 feet during 1908-11. The elevation of zero maintained at 90.27 feet during 1912-16.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—Sandy and slightly shifting.

Discharge measurements.—Made by wading.

Winter flow.—Station not maintained during winter.

Diversions.—F. Cross and A. M. Cross divert water above this station for irrigation. F. Cross was the only one to divert water during 1915 and 1916.

Observer.—Frank Cross.

DISCHARGE MEASUREMENTS of North branch of Frenchman river at F. Cross' ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
March 22	M. H. French	.....	.....	.....	.....*x*	138.0*w*
April 3	do	11.2	6.12	3.01	3.38	18.4*g*
April 10	do	20.0	20.60	1.60	1.34	33.0*g*
May 8	J. E. Caughey	11.6	8.04	1.54	0.70	12.4
June 8	do	12.0	7.12	1.24	0.62	8.8
July 10	do	12.0	7.10	1.04	0.64	7.4
July 24	do	12.0	7.25	0.78	0.63	5.7
Aug. 30	L. P. B. Miles	11.7	6.93	0.81	0.65	5.6
Oct. 27	do	11.6	7.24	1.35	0.76	9.8

x Gauge inaccessible.
w Weir measurements over Cross' dam.
g Ice going out.

DAILY GAUGE HEIGHT AND DISCHARGE of North branch of Frenchman river at F. Cross' ranch, for 1916

DAY	April		May		June		July	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.90	33.0*s*	0.75	15.2	0.83	13.4	0.58	5.7
2	3.65	25.0	0.73	14.6	0.82	13.2	0.50	4.8
3	3.38	18.4*d*	0.72	14.2	0.75	11.5	0.68	6.9
4	3.02	18.8	0.74	14.3	0.65	9.8	0.84	9.4
5	2.10	8.4	0.70	13.3	0.65	9.8	0.74	7.8
6	2.43	23.0	0.68	12.6	0.95	15.4	0.68	6.9
7	2.54	37.0	0.68	12.3	0.75	11.5	0.64	6.4
8	1.84	27.0	0.70	12.4*d*	0.62	8.8*d*	0.65	6.6
9	1.43	25.0	0.70	12.4	0.64	9.1	0.61	6.0
10	1.34	33.0*d*	0.71	12.6	0.70	10.0	0.63	6.3
11	1.32	32.0	0.69	12.1	0.83	12.4	0.61	6.0
12	1.18	28.0	0.67	11.8	0.95	14.7	0.60	5.9
13	1.17	28.0	0.69	11.9	0.76	11.2*s*	0.59	5.8
14	1.15	27.0	0.68	11.8	0.70	7.2	0.59	5.8
15	1.13	26.0	0.76	13.3	0.65	6.6	0.59	5.8
16	1.08	25.0	0.74	12.8	0.67	6.8	0.59	5.8
17	0.78	17.4	0.79	13.8	0.67	6.8	0.58	5.7
18	0.94	21.0	0.73	12.4	0.67	6.8	0.73	7.6
19	0.81	18.0	0.69	11.6	0.65	6.6	0.68	6.9
20	0.79	17.4	0.68	11.4	0.65	6.6	0.64	6.4
21	0.77	17.0	0.58	9.8	0.54	5.2	0.61	6.0
22	0.75	16.4	0.58	9.8	0.73	7.6	0.60	5.9
23	0.74	16.1	0.60	9.7	0.85	9.6	0.59	5.8
24	0.71	15.4	0.63	10.2	0.65	6.6	0.63	6.3
25	0.70	15.1	0.95	16.4	0.58	5.7	0.61	6.0
26	0.69	14.8	0.97	16.8	0.54	5.2	0.74	7.8
27	0.69	14.6	1.33	26.0	0.54	5.2	1.00	12.2
28	0.68	14.2	1.15	20.0	0.53	5.1	0.77	8.2
29	0.67	13.9	1.10	19.3	0.58	5.7	0.68	6.9
30	0.76	15.6	0.90	14.8	0.75	8.0	0.76	8.1
31	.....	.....	0.85	13.8	.....	.....	0.68	6.9

d Actual measurement.
s-s Shifting conditions.

DAILY GAUGE HEIGHT AND DISCHARGE of North branch of Frenchman river at F. Cross' ranch, for 1916—*Concluded*

DAY	August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	0.65	6.6	0.65	6.6	0.77	8.2
2	0.64	6.4	0.65	6.6	0.79	8.6
3	0.62	6.2	0.64	6.4	0.79	8.6
4	0.60	5.9	0.67	6.8	1.07	13.7
5	0.64	6.4	0.76	8.1	1.02	12.6
6	0.74	7.8	0.70	7.2	0.97	11.7
7	0.69	7.1	0.77	8.2	0.87	9.9
8	0.62	6.2	0.70	7.2	0.87	9.9
9	0.75	8.0	0.73	7.6	0.88	10.1
10	0.73	7.6	0.72	7.5	0.86	9.7
11	0.70	7.2	0.71	7.4	0.84	9.4
12	0.68	6.9	0.67	6.8	0.82	9.0
13	0.66	6.7	0.66	6.7	0.79	8.6
14	0.65	6.6	0.69	7.1	0.76	8.1
15	0.64	6.4	0.71	7.4	0.74	7.8
16	0.64	6.4	0.69	7.1	0.77	8.2
17	0.63	6.3	0.70	7.2	0.82	9.0
18	0.64	6.4	0.67	6.8	0.87	9.9
19	0.63	6.3	0.68	6.9	0.97	11.7
20	0.62	6.2	0.67	6.8	0.81	8.9
21	0.62	6.2	0.68	6.9	0.77	8.2
22	0.61	6.0	0.70	7.2	0.82	9.0
23	0.61	6.0	0.71	7.4	0.87	9.9
24	0.60	5.9	0.70	7.2	0.83	9.2
25	0.60	5.9	0.70	7.2	0.81	8.9
26	0.65	6.6	0.71	7.4	0.79	8.6
27	0.64	6.4	0.86	9.7	0.74	7.8
28	0.64	6.4	0.88	10.1	0.86	9.7
29	0.63	6.3	0.77	8.2	0.86	9.7
30	0.64	6.4	0.75	8.0	0.86	9.7
31	0.65	6.6	.....	.....	0.88	10.1

MONTHLY DISCHARGE of North branch of Frenchman river at F. Cross' ranch, for 1916

(Drainage area 53 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
April	37.0	8.4	21.0	0.396	0.44	1,250
May	26.0	9.7	13.7	0.258	0.30	842
June	15.4	5.1	8.7	0.164	0.18	518
July	12.2	4.8	6.7	0.126	0.15	412
August	8.0	5.9	6.5	0.123	0.14	398
September	10.1	6.4	7.4	0.140	0.16	440
October	13.7	7.8	9.5	0.179	0.21	584
The period	.....	.....	.....	.....	1.58	4,444

MEAN MONTHLY DISCHARGE in Second-feet of North branch of Frenchman river at F. Cross' ranch

MONTH	1907–8	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	8.8*b*	10.1	7.5	13.4	8.3	7.9	8.6	9.8	9.5	9.4	573
November	.....	.....	.....	.....	.....	15.9*e*	.....	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
March	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
April	.....	.....	10.8	47.0*a*	23.0*d*	82.0	41.0	19.0*c*	21.0	.....	39.0	2,302
May	.....	26.0	8.8	13.2	10.2	10.4	9.9	9.1	13.7	.....	12.7	780
June	.....	18.6	4.9	7.0	7.6	9.7	7.0	10.8	8.7	.....	9.3	552
July	.....	15.7	3.5	7.9	5.9	8.5	3.6	8.6	6.7	.....	7.6	465
August	4.6	7.5	4.8	6.8	6.2	6.6	4.4	7.5	6.5	.....	6.1	375
September	5.6	8.7	6.2	10.8	7.4	6.5	7.1	7.9	7.4	.....	7.5	447
Total in acre-ft.	615	4,983	2,978	5,218	4,024	8,401	4,847	4,211	4,463	.....	.....	5,494

a 10-30.
b 1-19.
c 4-30.
d 11-30.
e 1-5.

W. H. BARNETT DITCH FROM DOYLE CREEK

Location.—On the SE. ¼ Sec. 17 Tp. 7, Rge. 22, W. 3rd Mer., near East End post office.

Gauge.—Vertical staff attached to a four-inch round post driven into the bottom of the ditch about 100 feet S. 70°00E. from the flume; zero elevation maintained at 98.13 feet since establishment.

Bench-mark.—Permanent iron bench-mark, about one and one-half feet from the right bank of the ditch and two feet below the ga uge; assumed elevation 100.00 feet.

Channel.—One channel with clay bed.

Discharge measurements.—Made with a weir.

Observer.—W. H. Barnett.

Remarks.—This station was established on July 26, 1915, by M. H. French. No records were obtained in 1915 and 1916, but it is understood that no water was used in either year.

BARROBY DITCH FROM NORTH BRANCH OF FRENCHMAN RIVER

Location.—On SE. ¼ Sec. 33, Tp. 6, Rge. 23, W. 3rd Mer.

Gauge.—Vertical staff nailed to a four-inch round post driven into the left bank of the ditch about one-quarter mile S.12° W. of the dam. Zero elevation maintained at 97.67 feet since establishment.

Bench-mark.—Permanent iron bench-mark, situated five feet above the gauge and one and one-half feet from the right bank; assumed elevation 100.00 feet.

Channel.—One; bed of sandy loam.

Discharge measurements.—Made with current-meter or weir.

Observer.—Frank Barroby.

Remarks.—No water used during 1915 and 1916. Station visited and no flow reported.

FRENCHMAN RIVER AT PHILLIPS' RANCH

Location.—On the NE. ¼ Sec. 23, Tp. 6, Rge. 23, W. 3rd Mer., at A. T. Phillips' ranch near Ravenscrag.

Records available.—July 9, 1912, to October 31, 1915.

Gauge.—Vertical staff. The elevation of the zero of the gauge has been 3,058.50 feet since the station was established.

Bench-mark.—Permanent iron bench-mark, elevation 3,068.56 feet above sea-level (Canadian Pacific Railway datum).

Channel.—Permanent.

Discharge measurements.—Made by wading or from cable.

Winter flow.—Station not maintained during winter.

Artificial control.—A permanent control was established at this station during October, 1914, by which means more accurate records should be obtained at this station. This control was damaged by ice and floods, during spring run-off in 1916. Repairs were made in October. Shifting conditions prevailed during summer months.

Observer.—A. T. Phillips.

DISCHARGE MEASUREMENTS of Frenchman river at Phillips' ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 29	M. H. French	42.0	112.5	5.44	4.11	612
April 4	do	52.0	79.4	2.54	2.92	202
April 7	do	49.0	65.7	2.38	2.76	156
May 10	J. E. Caughey	29.0	35.6	2.32	2 29	84
June 9	do	34.0	52 8	3.05	2.66	161
July 8	do	29.0	29.1	2.23	2.25	65
July 28	do	40.0.	75.5	4.88	3.46	368
Aug. 26	L. P. B. Miles	26.0	21.5	1.49	1.90	32
Oct. 12	do	30.4	37.1	2.21	1.91*x*	82
Nov. 2	do	28.0	27.7	1.91	1.64	53

Artificial control leaking; damaged by spring floods.
x New artificial control completed.

DAILY GAUGE HEIGHT AND DISCHARGE of Frenchman river at Phillips' ranch, for 1916

Day	February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			5.43	319*x*	3.53	392	2.39	92	3.01	226
2					3.31	317	2.36	87	2 82	178
3					3.13	261	2 27	74	2 70	150
4					2.95	210	2 43	98	2 54	118
5					2.85	185	2.43	98	2.49	108
6					2.78	168	2.42	96	2 81	175
7					2.72	155	2.37	88	3.32	321
8					2.71	152	2.57	123	2 93	205
9					2.82	178	2 46	103	2 61	131
10					3.18	276	2.24	70	2.50	110
11			5.43	319*e*	3.51	384	2.26	73	2.65	140
12			6.88	640*e*	3 49	378	2 24	70	3 59	412
13			7.83	1,329*w*	3.29	311	2 20	65	3.48	374
14			6.11	1,159*e*	3.24	295	2.14	58	3.02	229
15			4.93	989*e*	3.21	285	2.17	62	2.69	148
16			4.73	819*e*	3.00	223	2.20	65	2.54	118
17			4.67	649*e*	2.81	175	2 22	68	2.45	102
18			4.35	479*e*	2.81	175	2.20	65	2.36	87
19			4.31	309*e*	2.89	195	2.16	61	2 29	77
20			3.91	162*d*	2.79	171	2.10	54	2.26	73
21	4.11	192*x*	6.30	600*e*	2.69	148	2.10	54	2 22	68
22	5.23	588	6.63	1,040*e*	2.63	135	2.08	52	2 27	74
23	5.49	745	5.53	1,290*e*	2.61	131	2.09	53	2.72	155
24	5.31	647	4 23	530*e*	2.53	116	2 12	56	3.08	246
25	5.35	662	3.65	160*e*	2.48	107	2.59	127	2.88	192
26	5.88	1,026	3.68	140*e*	2.39	92	2.92	202	2.62	133
27	5.57	785	4.78	893	2.39	92	3.30	314	2.48	107
28	5.25	610	4.78	893	2.45	102	3.58	409	2.39	92
29	4.93	460	4.25	670	2.57	123	3.52	388	2.34	84
30			3.72	459	2.45	102	3.48	374	2.48	107
31			3.47	371			3.33	323		

x-x Discharge determined from slope data; no records Mar. 2 to Mar. 10.
w Discharge determined from head on Strong's dam.
e Discharge estimated.
d Actual measurement at East End.

DAILY GAUGE HEIGHT AND DISCHARGE of Frenchman river at Phillips' ranch, for 1916—*Concluded*

Day	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.60	129	2.36	87	1.84	31	.....	56*e*
2	2.48	107	2.21	66	1.84	31	.....	65*e*
3	2.42	96	2.08	52	1.84	31	.....	75*e*
4	2.59	127	2.04	48	1.91	36	.....	85*e*
5	2.56	121	2.02	46	1.96	40	.....	90*e*
6	2.44	100	2.05	49	1.98	42	.....	95*e*
7	2.30	78	2.04	48	1.95	40	.....	90*e*
8	2.24	70	2.00	44	1.95	40	.....	90*e*
9	2.21	66	2.03	47	1.97	41	.....	87*e*
10	2.28	75	2.18	63	1.96	40	.....	83*e*
11	2.25	72	2.24	70	1.93	38	1.86	80*x*
12	2.13	57	2.23	69	1.93	38	1.90	82*d*
13	2.07	51	2.18	63	1.88	34	1.97	89
14	2.04	48	2.10	54	1.86	32	1.97	89
15	2.02	46	2.04	48	1.85	32	1.93	83
16	2.00	44	1.99	43	1.85	32	1.89	78
17	2.03	47	1.95	40	1.85	32	1.82	70
18	2.08	52	1.94	39	1.85	32	1.79	67
19	2.10	54	1.90	35	1.84	31	1.76	64
20	2.10	54	1.90	35	1.83	30	1.74	62
21	2.08	52	1.90	35	1.80	28	1.71	59
22	2.02	46	1.92	37	1.78	27	1.70	58
23	1.96	40	1.90	35	1.77	26	1.71	59
24	1.92	37	1.86	32	1.80	28	1.71	59
25	1.90	35	1.84	31	1.84	31	1.71	59
26	1.92	37	1.88	34	1.88	34	1.69	57
27	2.73	157	1.87	33	2.00	44	1.67	55
28	3.52	388	1.86	32	2.15	60	1.66	54
29	2.90	197	1.85	32	2.24	60*e*	1.65	53
30	2.71	152	1.85	32	.....	58*ex*	1.69	57
31	2.52	114	1.86	32	.....	.....	1.67	55

e Discharge estimated.
x Work on new control started Sept. 30. New control completed, Oct. 11.
d Actual measurement at East End.

MONTHLY DISCHARGE of Frenchman river at Phillips' ranch, for 1916

(Drainage area 598 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
February (21-29)	1,026	192	635	1.060	0.35	11,333
March (1, 11-31)	1,329	319	646	1.080	0.88	28,182
April	392	92	201	0.336	0.37	11,960
May	409	52	127	0.212	0.24	7,809
June	412	68	158	0.264	0.29	9,402
July	388	35	89	0.149	0.17	5,472
August	87	31	46	0.077	0.09	2,828
September	60	26	37	0.062	0.07	2,202
October	95	53	71	0.119	0.14	4,366
The period	.....	.....	.....	.....	2.60	83,554

MEAN MONTHLY DISCHARGE in Second-feet of Frenchman river at Phillips' ranch

MONTH	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October		22.0	17.2	22	24	71	31	1,921
November		35.0*b*						
December								
January								
February					635*f*			
March			81.0*d*	69*e*	646*h*			
April		443.0*c*	236.0	342	201		260	15,451
May		55.0	43.0	49	127		68	4,207
June		36.0	28.0	73	158		74	4,393
July	23.0*a*	24.0	7.1	60	89		45	2,762
August	16.9	13.7	4.8	27	46		22	1,333
September	18.0	13.3	13.5	22	37		21	1,235
Total in acre-ft.	3,141	32,971	24,002	37,086	80,664			31,302

a 9-31.
b 1-15.
c 6-30.
d 13-31.
e 22-31.
f 21-29.
h 11-31.

STRONG'S DITCH AT EAST END

Location.—On the NE. ¼ Sec. 25, Tp. 6, Rge. 22, W. 3rd Mer., about one-half mile below the headgate of the ditch.

Records available.—May 9, 1909, to October 31, 1916.

Gauge.—Vertical staff fastened to a post on the right bank; the elevation of the zero of the gauge maintained at 2,982.47 feet since establishment.

Bench-mark.—Permanent iron bench-mark near the gauge; elevation 2,994.31 (C.P.R. datum).

Channel.—Slightly shifting and affected by weeds.

Discharge measurements.—Made with current-meter by wading.

Observer.—Chester Torkelson.

Remarks.—Records for 1916 unreliable because of beaver dam in ditch; 1915 curve used as base for shifting conditions throughout season.

No daily records for 1916 prior to June 1—unable to secure services of an observer.

DISCHARGE MEASUREMENTS of Strong's ditch at East End, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
May 14	J. E. Caughey	10	3.90	0.72	0.85	2.8*h*
June 13	do	13	9.40	1.03	1.32	9.7
July 7	do	14	12.40	0.80	1.55	9.9
July 20	do	13	12.80	2.11	1.65	2.7
Sept 29	L. B. P. Miles				Dry	Nil

h Ditch partly shut off.

DAILY GAUGE HEIGHT AND DISCHARGE of Strong's ditch at East End, for 1916

DAY	June		July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.30	11.5	1.30	5.1	1.65	2.70	1.01	Nil	Dry	Nil
2	1.30	11.3	1.35	6.0	1.85	6.40	0.84	"	"	"
3	1.30	11.1	1.35	5.8	1.75	4.30	Dry	"	"	"
4	1.30	10.9	1.35	5.6	1.71	3.60	"	"	"	"
5	1.30	10.7	1.40	6.5	1.56	1.70	"	"	"	"
6	1.30	10.5	1.40	6.3	1.51	1.25	"	"	"	"
7	1.30	10.3	1.40	6.1	1.36	0.40	"	"	"	"
8	1.30	10.2	1.40	5.5	1.50	1.20	"	"	"	"
9	1.30	10.0	1.55	8.3	1.76	4.50	"	"	"	"
10	1.30	9.8	1.60	8.9	1.85	6.40	"	"	"	"
11	1.30	9.6	1.60	8.1	1.86	6.70	"	"	"	"
12	1.30	9.3	1.60	7.4	1.90	7.60	"	"	"	"
13	1.30	9.1	1.55	5.5	1.90	7.60	"	"	"	"
14	1.30	8.9	1.55	4.9	1.93	8.40	"	"	"	"
15	1.30	8.7	1.55	4.2	1.93	8.40	"	"	"	"
16	1.30	8.4	1.60	4.5	2.03	11.20	"	"	"	"
17	1.30	8.2	1.60	3.9	1.97	9.50	"	"	"	"
18	1.25	6.7	1.60	3.3	1.98	9.80	"	"	"	"
19	1.25	6.5	1.60	2.7	1.96	9.20	"	"	"	"
20	1.25	6.3	1.60	2.1	1.97	9.50	"	"	"	"
21	1.25	6.1	1.60	2.1	1.94	8.70	"	"	"	"
22	1.25	5.9	1.65	2.7	1.86	6.60	"	"	"	"
23	1.25	5.6	1.65	2.7	1.77	4.70	"	"	"	"
24	1.25	5.4	1.65	2.7	1.95	9.00	"	"	"	"
25	1.25	5.3	1.65	2.7	2.00	10.40	"	"	"	"
26	1.25	5.1	1.65	2.7	2.04	11.60	"	"	"	"
27	1.25	4.9	1.65	2.7	2.05	11.80	"	"	"	"
28	1.25	4.7	1.65	2.7	2.05	11.80	"	"	"	"
29	1.25	4.5	1.65	2.7	1.94	8.70	"	"	"	"
30	1.25	4.3	.....	2.7*e*	1.75	4.30	"	"	"	"
31	.....	.....	1.65	2.7	1.35	0.35	.....	.....	"	"

e Discharge estimated.
Discharge affected by beaver dams from July 20 to end of season.

MONTHLY DISCHARGE of Strong's ditch at East End, for 1916

MONTH	DISCHARGE IN SECOND-FEET				Total Discharge in Acre-ft.
	Maximum	Minimum	Mean	Per square Mile	
June	11.5	4.30	8.0	.....	476
July	8.9	2.10	4.5	.....	277
August	11.8	0.35	6.7	.....	412
September	Nil	Nil	Nil	.....	0
October	"	"	"	.....	0
The period	.....	.....	.....	.....	1,165

FRENCHMAN RIVER AT EAST END

Location.—On the SE. ¼ Sec. 31, Tp. 6, Rge. 21, W. 3rd Mer., at the Canadian Pacific Railway bridge about one-half mile east of the East End depot.

Records available.—April 21, 1909, to October 31, 1916.

Gauge.—Vertical staff fastened to the downstream pile of the fifth bent from the west end of of the bridge. The elevation of the zero of the gauge is 2,958.97 feet above sea-level.

Bench-mark.—On July 31, 1915, a permanent iron bench-mark was set on the left bank above high water mark, thirty feet from the edge of the cut-bank and near the gate on the R.N.W.M.P. grounds. Referred to the Canadian Pacific railway datum, the elevation is 2,975.19 feet above sea-level.

Channel.—Permanent.

Discharge measurements.—Made with a current-meter by wading or from a bridge.

Winter flow.—Station not maintained in winter.

Artificial control.—A permanent control for the gauge was established during October, one-quarter mile down stream from the gauge at the bridge.

Diversions.—Mr. J. C. Strong diverts water for irrigation purposes about two miles up stream from this station. A small amount returns to the river channel, above the gauge.

Observer.—Byron Walters, Wm. Jas. Brummitt and C. Torkelson.

DISCHARGE MEASUREMENTS of Frenchman river at East End, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 20	M. H. French	106.0	62.9	2.57	5.28	162
Mar. 30	do	106.0	121.0	3.46	4.98	419
Mar. 31	do	55.0	258.5	1.59	3.96	412
April 1	do	55.0	245.0	1.58	3.73	387
April 3	do	68.0	101.9	2.72	3.21	278
April 8	do	61.0	74.0	2.22	2.66	164
May 6	J. E. Caughey	33.7	35.8	3.07	2.43	110
May 12	do	22.5	17.6	2.33	1.96	41
June 14	do	37.5	164.1	1.88	3.14	310
July 7	do	26.0	25.4	3.07	2.25	78
July 20	do	22.0	16.0	3.18	2.04	51
July 31	L. P. B. Miles	34.0	41.7	3.50	2.61	146
Aug. 26	do	20.5	13.1	2.45	1.83	32
Sept. 27	do	20.0	11.2	2.86	1.92	32
Nov. 4	do	24.0	17.2	2.97	2.03	51

DAILY GAUGE HEIGHT AND DISCHARGE of Frenchman river at East End, for 1916

Day	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			3.73	387*d*	2.18	69	3.70	520
2			3.78	452	2.09	57	3.60	480
3			3.21	278*d*	2.49	122	3.60	480
4			3.08	244	2.40	105	3.60	480
5			2.79	173	2.50	124	3.40	400
6			2.69	155	2.40	105	3.30	360
7			2.69	159	2.30	88	3.30	360
8			2.70	166	2.30	88	3.20	320
9			2.70	166	2.30	88	3.10	284
10			3.40	400	2.30	88	3.00	250
11			3.61	484	2.30	88	3.00	250
12			3.71	524	2.20	72	2.90	219
13			3.31	364	2.20	72	2.80	190
14			3.22	328	2.20	72	2.80	190
15			3.02	257	2.10	58	2.70	166
16			2.82	196	2.10	58	2.70	166
17			2.73	173	2.10	58	2.60	144
18			2.73	173	2.10	58	2.60	144
19	5.48	180*e*	2.43	110	2.00	46	2.50	124
20	5.28	162*d*	2.14	64	2.00	46	2.50	124
21	5.58	650*e*	2.14	64	2.00	46	2.50	124
22	9.33	1,100*e*	2.04	51	2.00	46	2.40	105
23	9.73	1,400*e*	2.15	65	2.00	46	2.40	105
24	7.58	700*e*	2.25	80	2.00	46	2.40	105
25	5.48	300*e*	2.05	52	2.10	58	2.50	124
26	4.98	240*e*	2.16	66	2.60	144	2.40	105
27	6.08	950*e*	2.06	53	3.00	250	2.30	88
28	6.88	1,025*e*	2.26	82	3.50	440	2.30	88
29	5.08	620*e*	2.07	54	3.50	440	2.20	72
30	4.98	419*d*	2.17	68	3.60	480	2.20	72
31	3.96	412*d*			3.60	480		

e Discharge estimated.
d Actual measurement.

DAILY GAUGE HEIGHT AND DISCHARGE of Frenchman river at East End, for 1916.—*Concluded.*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.20	72	2.40	105	1.88	34	2.00	46
2	2.35	96	2.24	78	2.00	46	2.07	54
3	2.30	88	2.14	64	1.87	33	2.10	58
4	2.30	88	2.00	46	1.85	32	2.10	58
5	2.25	80	1.96	42	1.86	32	2.10	58
6	2.25	80	1.96	42	1.87	33	2.13	62
7	2.25	80	1.97	43	1.84	31	2.15	65
8	2.20	72	1.94	40	1.92	38	2.16	66
9	2.15	65	1.94	40	1.91	37	2.16	66
10	2.15	65	1.99	45	1.90	36	2.23	77
11	2.05	52	2.02	48	1.89	35	2.26	82
12	2.05	52	2.15	65	1.86	32	2.30	88
13	2.03	50	2.10	58	1.84	31	2.32	91
14	2.00	46	2.07	54	1.85	32	2.32	91
15	2.00	46	2.03	50	1.84	31	2.33	93
16	2.00	46	1.96	42	1.83	30	2.32	91
17	2.00	46	1.94	40	1.85	32	2.25	80
18	2.15	65	1.87	33	1.86	32	2.23	77
19	2.10	58	1.86	32	1.84	31	2.20	72
20	2.04	51	1.86	32	1.84	31	2.16	66
21	2.04	51	1.84	31	1.84	31	2.14	64
22	2.00	46	1.86	32	1.85	32	2.13	62
23	1.90	36	1.85	32	1.85	32	2.12	61
24	1.90	36	1.86	32	1.84	31	2.10	58
25	2.00	46	1.81	28	1.86	32	2.12	61
26	2.10	58	1.84	31	1.86	32	2.11	59
27	2.00	46	1.84	31	1.87	33	2.12	61
28	3.30	360	1.84	31	1.96	42	2.11	59
29	2.96	237	1.86	32	1.97	43	2.10	58
30	.....	181*e*	1.85	32	1.98	44	2.13	62
31	2.61	146	1.87	33	.....	.....	2.12	61

e Discharge estimated.

MONTHLY DISCHARGE of Frenchman river at East End, for 1916

(Drainage area 648 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (19-31)	1,400	162	627	0.968	0.47	16,163
April	524	51	196	0 302	0.34	11,663
May	480	46	130	0 201	0.23	7,993
June	520	72	221	0.341	0.38	13,150
July	360	36	82	0.127	0.15	5,042
August	105	28	43	0.066	0.08	2,644
September	46	30	34	0.052	0.06	2,023
October	93	46	68	0.105	0.12	4,181
The period	.....	.....	.....	.....	1.83	62,859

Discharge of approximately 50 second-feet per day continued during first part of November.

MEAN MONTHLY DISCHARGE of Frenchman river at East End

(Area of watershed 648 square miles)

(Average run-off per square mile 73.3 acre-feet.)

YEAR	Mar. Sec.-ft.	April Sec.-ft.	May Sec.-ft.	June Sec.-ft.	July Sec.-ft.	Aug. Sec.-ft.	Sept. Sec.-ft.	Oct. Sec.-ft.	Nov. Sec.-ft.	Total Acre-ft.	Remarks
1909..	.....	*554a*	235	205	143	33	21	41	.....	46,789	*a* Records incomplete; omitted from averages.
1910..	.....	*54a*	39	21	6	5	7	10	.....	*6,854a*	
1911..	.....	401	83	53	37	22	21	32	.....	38,967	*b* Records at Phillips' ranch for 1913 used.
1912..	.....	523*c*	173	59	54	22	27	17	*27a*	39,760	*c* Reduced to monthly average.
1913..	.....	443*bc*	55	36	24	14*c*	13	17	.....	31,625*b*	
1914..	50*c*	247	36	28	8	3	9	27	.....	24,578	Small flow during winter months
1915..	28*c*	352	57	91	73	33	31	26	.....	41,541	Records include Enright & Strong diversions.
1916..	263*c*	196	130	221	82	43	34	68	.....	62,859	
Av. Sec.-ft	114	360	101	89	53	22	20	29	.....	40,874	
Av. Ac.-ft	7,010	21,421	6,210	5,296	3,259	1,353	1,190	1,783	.....	47,522	

MORRISON BROTHERS' DITCH FROM FRENCHMAN RIVER

Location.—On the SW. ¼ Sec. 26, Tp. 6, Rge. 21, W. 3rd Mer., about three miles down stream from East End.

Records available.—June 12 to August 28, 1913; May 25 to October 30, 1914, and May 12 to June 27, 1915.

Gauge.—Vertical staff fastened to a post at the right bank about one-half mile from the headgate; the elevation of the zero of the gauge has been maintained at 97.24 feet since establishment.

Bench-mark.—Permanent iron bench-mark located on the right bank near the gauge; assumed elevation 100.00 feet.

Channel.—Slightly grown with weeds.

Discharge measurements.—Made with current-meter.

Observer.—A. A. Morrison.

Remarks.—No water used during 1916.

MULE CREEK AT GUNN'S RANCH

Location.—On the SW. ¼ Sec. 33, Tp. 5, Rge. 17, W. 3rd Mer., prior to June 16, 1916, and on the NE. ¼ Sec. 33, Tp. 5, Rge. 17, W. 3rd Mer., since that date.

Records available.—April 15, 1914, to November 8, 1916.

Gauge.—Vertical staff; zero elevation has been maintained at 92.46 feet since establishment. High water staff installed August 4, 1916; zero elevation 95.46 feet

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Discharge measurements.—Made with current-meter at high stages, and with weir at low stages.

Channel.—Probably permanent.

Winter flow.—This station is not maintained during the winter.

Diversions.—There is no diversion above this station.

Observer.—Wm. Gunn, Jr.

Remarks.—Staff gauge carried out with ice about March 12, 1916, when creek began to flow. March 25, maximum reading 6.34 feet. Creek remained high one week, dropping to three feet level April 3, and after April 10 dropped gradually to 1.19 feet on April 27, when new gauge was set.

Flood on July 4, with maximum gauge height 9.40 feet, carried out gauge. New gauge est August 4.

Discharge Measurements of Mule creek at Gunn's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 27	J. E. Caughey	2.3	0.99	0.55	1.19	0.55
May 17	do	2.5	2.52	0.70	1.59	1.77
June 2	do	2.4	2.11	0.59	1.44	1.25
June 16	do	.....	.....	.....	1.09	0.62*w*
June 27	do	.....	.....	.....	1.08	0.58*w*
Aug. 4	L. B. P. Miles	.....	.....	.....	1.08	0.21*w*
Aug. 18	do	.....	.....	.....	1.02	0.19*w*
Sept. 21	do	.....	.....	.....	0.94	0.18*w*
Nov. 11	do	.....	.....	.....	1.05	0.31*w*

w Weir measurements.

Daily Gauge Height and Discharge of Mule creek at Gunn's ranch, for 1916

Day	August		September		October		November	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	0.40*e*	0.97	0.22	1.20	0.60	1.14	0.48
2	.....	0.38*e*	0.99	0.24	2.00	4.20	1.15	0.50
3	.....	0.37*e*	1.02	0.28	2.60	9.80	1.17	0.54
4	1.08	0.37	1.04	0.31	2.60	9.80	1.16	0.52
5	1.09	0.38	0.99	0.24	2.80	12.30	1.18	0.56
6	1.11	0.42	0.97	0.22	2.83	12.70	1.16	0.52
7	1.08	0.37	0.98	0.23	2.00	4.20	1.15	0.50
8	1.10	0.40	1.00	0.25	1.80	2.90	1.20	0.60
9	3.30	20.00	0.99	0.24	1.60	1.85	.....	.....
10	2.50	8.70	1.01	0.26	1.45	1.28	.....	.....
11	1.85	3.20	1.03	0.30	1.25	0.72	.....	.....
12	1.60	1.85	1.01	0.26	1.17	0.54	.....	.....
13	1.35	0.96	0.99	0.24	1.13	0.46	.....	.....
14	1.15	0.50	0.97	0.22	1.11	0.42	.....	.....
15	1.12	0.44	0.98	0.23	1.12	0.44	.....	.....
16	1.10	0.40	1.00	0.25	1.10	0.40	.....	.....
17	1.08	0.37	1.01	0.26	1.08	0.37	.....	.....
18	1.02	0.28	1.00	0.25	1.07	0.36	.....	.....
19	1.01	0.26	0.99	0.24	1.09	0.38	.....	.....
20	0.98	0.23	0.96	0.21	1.11	0.42	.....	.....
21	0.97	0.22	0.94	0.19	1.13	0.46	.....	.....
22	0.99	0.24	0.92	0.17	1.12	0.44	.....	.....
23	1.01	0.26	0.94	0.19	1.14	0.48	.....	.....
24	1.04	0.31	0.96	0.21	1.11	0.42	.....	.....
25	1.07	0.36	0.98	0.23	1.10	0.40	.....	.....
26	1.06	0.34	1.00	0.25	1.08	0.37	.....	.....
27	1.04	0.31	1.05	0.32	1.06	0.34	.....	.....
28	1.03	0.30	1.09	0.38	1.09	0.38	.....	.....
29	1.01	0.26	1.15	0.50	1.11	0.42	.....	.....
30	0.98	0.23	1.25	0.72	1.13	0.46	.....	.....
31	0.97	0.22	.....	.....	1.14	0.48	.....	.....

e Discharge estimated.

MONTHLY DISCHARGE of Mule creek at Gunn's ranch, for 1916

(Drainage area 60 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
August	20.00	0.22	1.40	0.023	0.03	86
September	0.72	0.17	0.27	0.004	0.00	16
October	12.70	0.34	2.20	0.037	0.04	135
November	0.60	0.48	0.53	0.009	0.00	8
The period					0.07	245

Daily records, April 27 to July 31, unreliable, not published.

BATE CREEK AT BATE'S RANCH

Location.—On SW. ¼ Sec. 7, Tp. 6, Rge. 16, W. 3rd Mer., near Nummola post office.

Records available.—Open water flow from April 15, 1915, to October 31, 1916.

Gauge.—Vertical staff fastened to a post on right bank about one-quarter mile from Mr. Bate's house; the elevation of the zero maintained at 94.87 feet in 1914, 92.77 feet in 1915, 92.27 feet to August 4, 1916, and 89.74 feet at a new section from August 5 to October 31, 1916.

Bench-mark.—Wooden plug driven in the right bank, 100 feet from the gauge; assumed elevation 100.00 feet.

Channel.—Probably permanent.

Discharge measurements.—Made with current-meter and weir.

Diversions.—Mr. Bate diverts water for irrigation purposes above the gauge.

Observer.—A. E. Bate.

Remarks.—Flood of July 2-3 scoured out creek bottom at gauge, necessitating its re-establishment at a new section.

Creek continued to flow small trickle during first part of November.

DISCHARGE MEASUREMENTS of Bate creek at Bate's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 26	J. E. Caughey				1.50	0.42*w*
May 17	do				1.54	0.62*w*
June 2	do				1.55	0.71*w*
June 17	do				1.51*c*	0.53*w*
June 27	do				1.37*c*	0.29*w*
Aug. 5	L. B. P. Miles				0.25*p*	0.27*w*
Aug. 5	do				0.60*f*	0.27*w*
Aug. 18	do				0.54	0.10*w*
Sept. 21	do				0.65	0.18*w*
Nov. 11	do				0.55	0.07*w*

w Discharge determined by using a 24-inch weir.
c Gauge height affected by backwater from vegetation.
p Gauge height affected by scour from flood of July 2.
Staff gauge re-established at new section.

DAILY GAUGE HEIGHT AND DISCHARGE of Bate creek at Bate's ranch, for 1916

DAY	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	2.01	2.90	1.44	0.38	1.60	0.80
2	.....	.....	1.74	1.36	1.48	0.46	1.51	0.53
3	.....	.....	1.62	0.88	1.46	0.42	1.46	0.42
4	.....	.....	1.66	1.04	1.52	0.56	1.52	0.56
5	.....	.....	1.75	1.40	1.48	0.46	1.96	2.50
6	.....	.....	1.73	1.32	1.48	0.46	1.59	0.77
7	.....	.....	1.77	1.48	1.44	0.38	1.48	0.46
8	.....	.....	1.86	1.90	1.43	0.36	1.48	0.46
9	.....	.....	1.72	1.28	1.44	0.38	1.51	0.53
10	3.81*b*	20.00*e*	1.80	1.60	1.50	0.50	1.84	1.80
11	4.20	70.00*e*	1.81	1.65	1.48	0.46	1.55	0.65
12	3.98*b*	20.00*e*	1.88	2.00	1.50	0.50	1.48	0.46
13	2.28	5.10	1.86	1.90	1.50	0.50	1.48	0.46
14	1.38	0.27	1.76	1.44	1.49	0.48	1.48	0.46
15	1.13	0.02	1.74	1.36	1.56	0.68	1.46	0.42
16	1.12	0.01	1.72	1.28	1.73	1.32	1.44	0.38
17	1.15	0.02	1.66	1.04	1.54	0.62	1.49	0.48
18	1.18	0.04	1.66	1.04	1.50	0.50	1.40	0.30
19	1.33	0.20	1.66	1.04	1.48	0.46	1.39	0.28
20	1.95	2.40	1.58	0.74	1.48	0.46	1.38	0.27
21	4.10	118.00	1.55	0.65	1.50	0.50	1.46	0.42
22	1.53	0.59	1.54	0.62	1.49	0.48	1.98	2.70
23	1.29	0.14	1.52	0.56	1.52	0.56	1.56	0.68
24	1.25	0.10	1.50	0.50	1.50	0.50	1.49	0.48
25	1.40	0.30	1.51	0.53	2.40	6.40	1.38	0.27
26	2.20	4.40	1.50	0.50	2.20	4.40	1.34	0.21
27	2.60	9.30	1.44	0.38	1.69	1.16	1.38	0.27
28	2.68	10.80	1.44	0.38	1.69	1.16	1.39	0.28
29	2.52	8.00	1.48	0.46	1.68	1.12	1.75	1.40
30	2.58	9.00	1.46	0.42	1.74	1.36	1.55	0.65
31	2.50	7.70	.....	.....	1.62	0.88	.....	.....

b-b Ice conditions.
e Discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of Bate creek at Bate's ranch, for 1916.—*Concluded.*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.32	0.18	0.25	0.26	0.54	0.08	0.69	0.41
2	3.30	46.00	0.25	0.26	0.52	0.06	0.72	0.51
3	3.55*p*	119.00*e*	0.25	0.26	0.54	0.08	0.74	0.58
4	0.76	2.10	0.25*p*	0.26	0.61	0.20	0.75	0.62
5	0.57	1.16	0.58*f*	0.14	0.58	0.14	0.75	0.62
6	0.91	3.00	0.58	0.14	0.58	0.14	0.80	0.82
7	0.49	0.84	0.56	0.11	0.57	0.13	0.76	0.66
8	0.37	0.48	0.57	0.13	0.57	0.13	0.74	0.58
9	0.39	0.53	0.63	0.25	0.63	0.25	0.74	0.58
10	0.34	0.42	0.62	0.22	0.63	0.25	0.72	0.51
11	0.33	0.40	0.62	0.22	0.58	0.14	0.72	0.51
12	0.31	0.36	0.62	0.22	0.58	0.14	0.72	0.51
13	0.31	0.36	0.59	0.16	0.64	0.27	0.71	0.48
14	0.31	0.36	0.58	0.14	0.58	0.14	0.70	0.44
15	0.31	0.36	0.56	0.11	0.63	0.25	0.70	0.44
16	0.30	0.34	0.56	0.11	0.64	0.27	0.70	0.44
17	0.29	0.32	0.53	0.07	0.64	0.27	0.71	0.48
18	0.89	2.90	0.51	0.05	0.64	0.27	0.74	0.58
19	0.31	0.36	0.50	0.04	0.64	0.27	0.71	0.48
20	0.27	0.28	0.52	0.06	0.63	0.25	0.72	0.51
21	0.25	0.26	0.52	0.06	0.64	0.27	0.73	0.55
22	0.25	0.26	0.52	0.06	0.65	0.29	0.71	0.48
23	0.25	0.26	0.52	0.06	0.64	0.27	0.70	0.44
24	0.27	0.28	0.53	0.07	0.65	0.29	0.71	0.48
25	0.27	0.28	0.57	0.13	0.66	0.32	0.71	0.48
26	0.27	0.28	0.56	0.11	0.66	0.32	0.71	0.48
27	0.34	0.42	0.54	0.08	0.76	0.66	0.73	0.55
28	0.27	0.28	0.53	0.07	0.70	0.44	0.71	0.48
29	0.36	0.46	0.52	0.06	0.70	0.44	0.70	0.44
30	0.28	0.30	0.52	0.06	0.68	0.38	0.70	0.44
31	0.27	0.28	0.54	0.08	.....	.....	0.70	0.44

p Gauge heights July 3 to August 4 affected by scour from flood July 2.
f Staff gauge re-established at new section.
e Discharge estimated.

MONTHLY DISCHARGE of Bate creek at Bate's ranch, for 1916

(Drainage area 12 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (10-31)	118.00	0.01	13.00	1.080	0.88	567
April	2.90	0.38	1.12	0.093	0.10	67
May	6.40	0.36	0.93	0.078	0.09	57
June	2.70	0.21	0.68	0.057	0.06	40
July	119.00	0.18	5.90	0.492	0.57	363
August	0.26	0.04	0.13	0.011	0.01	8
September	0.66	0.06	0.25	0.021	0.02	15
October	0.82	0.41	0.52	0.043	0.05	32
The period	.....	.....	.....	.....	1.78	1,149

Small flow continued during first part of November.

FRENCHMAN RIVER AT "76" RANCH

Location.—On the SE. ¼ of Sec. 27, Tp. 5, Rge. 16, W. 3rd Mer., at the "76" ranch near Waldville post office.

Records available.—April 10, 1914, to October 11, 1915.

Gauge.—Vertical staff; zero elevation has been maintained at 87.95 feet during 1914 and 1915, and at elevation 88.66 feet during 1916.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—Probably permanent.

Discharge measurements.—Made by wading or from cable.

Winter flow.—Station not maintained during winter.

Diversions.—Messrs. Enright and Strong and Messrs. Morrison Brothers, Duncan and Watson, divert water from the stream some fifty miles above the station.

Observers.—Mrs. Hazelle MacDonald and T. P. Nash.

DISCHARGE MEASUREMENTS of Frenchman river at "76" ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 25	J. E. Caughey	63.0	82.6	2.17	3.36	180
May 17	do	61.0	59.4	1.75	2.83	104
June 2	do	55.0	190.0	2.01	4.13	381
June 17	do	64.0	100.9	2.17	3.43	219
June 27	do	64.0	95.0	2.33	3.53	221
Aug. 5	L. B. P. Miles	64.0	49.5	1.74	2.70	86
Aug. 6	do	62.5	48.5	1.71	2.59	83
Aug. 17	do	59.0	51.0	1.43	2.53	73
Sept. 9	do	41.0	25.8	1.43	2.27	37
Sept. 20	do	40.5	22.3	1.49	2.20	33
Nov. 13	do	35.0	56.2	0.66	2.56	37i

i Stream frozen over.

DAILY GAUGE HEIGHT AND DISCHARGE of Frenchman river at "76" ranch, for 1916

DAY	April		May		June		July	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			3.16	156	4.26	420	3.30	180
2			3.28	176	4.08	366	3.35	189
3			3.18	159	3.78	282	10.90	2,412
4			3.08	143	3.55	229	5.32	738
5			3.00	130	3.34	187	3.43	205
6			3.00	130	3.33	185	4.15	387
7			3.08	143	3.19	160	4.10	372
8			3.08	143	3.07	141	3.47	213
9			3.00	130	3.62	243	3.21	164
10			2.95	122	3.94	325	2.90	115
11			3.00	130	3.52	223	2.80	101
12			3.12	149	3.25	171	2.78	98
13			3.00	130	3.10	146	2.70	87
14			2.85	108	3.54	227	2.70	87
15			2.87	111	4.16	390	2.66	81
16			2.82	104	3.82	292	2.60	74
17			2.82	104	3.46	211	2.55	68
18			2.80	101	3.30	180	2.50	62
19			2.74	93	3.10	146	3.49	217
20			2.73	91	2.98	127	3.90	314
21			2.68	84	2.82	104	3.25	171
22			2.71	88	2.84	107	2.40	51
23			2.67	83	2.86	109	2.40	51
24			2.55	68	2.84	107	2.62	76
25	3.36	191	2.93	119	2.82	104	2.52	64
26	3.35	189	3.28	176	3.20	162	2.50	62
27	3.30	180	3.30	180	3.48	215	2.50	62
28	3.20	162	3.35	189	3.38	195	2.45	56
29	3.14	152	3.78	282	3.30	180	2.82	104
30	3.10	146	4.18	396	3.30	180	3.44	55
31			4.20	402			3.82	292

DAILY GAUGE HEIGHT AND DISCHARGE of Frenchman river at "76" ranch, for 1916—*Concluded*

Day	August		September		October		November	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.02	133	.....	38.0*e*	2.22	34	2.49	61
2	3.00	130	.....	38.0*e*	2.32	43	2.49	61
3	2.96	124	.....	38.0*e*	2.41	52	2.49	61
4	2.95	122	.....	37.0*e*	2.50	51	2.49	61
5	2.72	90	.....	37.0*e*	2.66	81	2.47	58
6	2.68	84	.....	37.0*e*	2.63	78	2.46	57
7	2.65	80	.....	37.0*e*	2.55	68	2.45	56
8	2.64	79	2.26	37.0	2.52	64	2.45	56
9	3.04	136	2.28	39.0	2.50	62	2.46	57
10	2.99	128	2.32	43.0	2.49	61	2.46	57
11	2.69	86	2.32	43.0	2.52	64	2.47	58
12	2.64	79	2.30	41.0	2.64	79	.....	.....
13	2.65	80	2.30	41.0	2.68	84	.....	.....
14	2.61	75	2.29	40.0	2.68	84	.....	.....
15	2.58	72	2.28	39.0	2.68	84	.....	.....
16	2.58	72	2.25	36.0	2.71	88	.....	.....
17	2.56	69	2.24	35.0	2.75	94	.....	.....
18	2.51	63	2.23	34.0	2.75	94	.....	.....
19	2.50	62	2.23	34.0	2.74	93	.....	.....
20	2.49	61	2.22	34.0	2.68	84	.....	.....
21	2.40	51	2.20	32.0	2.64	79	.....	.....
22	2.31	42	2.20	32.0	2.62	78	.....	.....
23	2.29	40	2.20	32.0	2.60	74	.....	.....
24	.....	40*e*	2.20	32.0	2.58	72	.....	.....
25	.....	40*e*	1.99	16.4	2.52	64	.....	.....
26	.....	40*e*	1.99	16.4	2.54	67	.....	.....
27	.....	39*e*	2.21	33.0	2.54	67	.....	.....
28	.....	39*e*	2.23	34.0	2.53	66	.....	.....
29	.....	39*e*	2.23	34.0	2.53	66	.....	.....
30	.....	39*e*	2.23	34.0	2.52	64	.....	.....
31	.....	38*e*	.....	.....	2.50	62	.....	.....

e Discharge estimated.

MONTHLY DISCHARGE of Frenchman river at "76" ranch, for 1916

(Drainage area 1,106 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-ft.
April (25-30)	191	146.0	170	0.154	0.03	2,023
May	402	68.0	149	0.135	0.16	9,162
June	420	104.0	204	0.184	0.21	12,139
July	2,412	51.0	233	0.211	0.24	14.327
August	136	38.0	73	0.066	0.08	4,489
September	43	16.4	35	0.032	0.04	2,083
October	94	34.0	71	0.064	0.07	4,366
November (1-11)	61	56.0	58	0.052	0.02	1,265
The period	.....	.....	.....	.....	0.85	49,854

SNAKE CREEK NEAR VAL MARIE

Location.—On SW. ¼ Sec. 16, Tp. 4, Rge. 13, W. 3rd Mer., about one-half mile east of Val Marie post office.

Records available.—April 7, 1914, to October 31, 1916.

Gauge.—Vertical staff; zero elevation has been maintained at 87.91 feet since establishment.

Bench-mark.—Permanent iron bench-mark located three feet north of the east tower of the cable; assumed elevation 100.00 feet.

Channel.—Permanent.

Discharge measurements.—Made with a current-meter from cable in flood stages, by wading at ordinary stages and with a weir at low stages.

Observer.—Jean Denniel.

DISCHARGE MEASUREMENTS of Snake creek near Val Marie, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 24	J. E. Caughey	6.0	8.40	1.40	2.25	11.80
May 18	do	5.5	2.75	0.87	0.97	2.40
May 31	do	14.0	18.80	1.12	2.54	21.00
June 19	do	2.8	2.09	1.39	1.35	2.90
June 26	do	7.6	6.57	1.05	1.95	6.90
Aug. 7	L. B. P. Miles	.....	.....	.....	1.00	1.12*w*
Aug. 15	do	3.2	1.20	0.75	0.92	0.90
Sept. 9	do	.....	.....	.....	0.76	0.46
Sept. 16	do	.....	.....	.....	0.74	0.45
Nov. 14	do	.....	.....	.....	0.66	0.42

w Discharge determined by using a 24-inch weir.

DAILY GAUGE HEIGHT AND DISCHARGE of Snake creek near Val Marie, for 1916

DAY	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	9.30	300.0*e*	1.47	3.40	2.52	20.0
2	.....	.....	8.80*b*	273.0*e*	1.41	3.00	2.27	12.4
3	.....	.....	7.60*g*	273.0*e*	1.32	2.50	2.02	7.9
4	.....	.....	6.45	216.0*e*	1.25	2.20	1.93	6.6
5	.....	.....	5.40*g*	163.0*e*	1.16	1.82	1.81	5.6
6	.....	.....	4.77	110.0	1.12	1.66	1.80	5.6
7	.....	.....	4.57	102.0	1.07	1.47	1.67	4.6
8	.....	.....	5.67	146.0	1.01	1.26	1.78	5 4
9	.....	.....	5.92	156.0	0.97	1.14	1.89	6.4
10	.....	.....	6.92	196.0	0.91	0.98	2.00	7.6
11	.....	.....	6.72	188.0	0.88	0.90	2.11	9.3
12	.....	.....	6.82	192.0	0.84	0.80	2.70	27 0
13	.....	.....	5.72	148.0	0.82	0.75	2.40	15.9
14	.....	.....	5.62	144.0	0.80	0.70	2.04	8.2
15	.....	.....	5.42	136.0	0.80	0.70	1.85	6.0
16	.....	.....	4.92	116.0	0.94	1.05	1.68	4.7
17	.....	.....	3.92	76.0	0.92	1.00	1.55	3.8
18	.....	.....	3.62	64.0	0 97	1.14	1.50	3.5
19	.....	.....	3.47	58.0	0.93	1.03	1.30	2.5
20	.....	.....	3.23	49.0	0.88	0.90	1.20	2.0
21	.....	.....	2.92	36.0	0.85	0.82	1.20	2.0
22	.....	.....	2.17	10.3	0.82	0.75	1.35	2.7
23	.....	.....	2.46	18.0	0.80	0.70	1.37	2.8
24	.....	.....	2 25	11.9	0.78	0.66	1.70	4.8
25	.....	.....	2.00	7.6	1.25	2.20	2.03	8.0
26	7.40*b*	50*e*	1.80	5.6	4.15	85.00	1.99	7.5
27	6.30	100*e*	1.64	4.4	3.97	78.00	1.70	4 8
28	7.15	100*e*	1.57	4.0	3.55	61.00	1.72	5.0
29	9.55	200*e*	1.55	3.8	2 88	35.00	1.62	4.3
30	11.00	300*e*	1.55	3.8	2 65	25.00	5.57	142.0
31	11.00	300*e*	.....	.....	2.54	21.00	.....	.....

b-b Ice conditions.
e Discharge estimated.
g Ice going out April 3-5.

DAILY GAUGE HEIGHT AND DISCHARGE of Snake creek near Val Marie, for 1916.—*Concluded.*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.07	82.00	2.38	15.30	0.70	0.52	0.87	0.87
2	3.36	54.00	2.15	10.00	0.71	0.54	0.87	0.87
3	7.40	215.00	1.78	5.40	0.71	0.54	0.88	0.90
4	6.35	173.00	1.65	4.50	0.74	0.58	0.88	0.90
5	4.02	80.00	1.34	2.70	0.75	0.60	0.88	0.90
6	3.77	70.00	1.16	1.82	0.74	0.58	0.92	1.00
7	4.03	81.00	1.08	1.51	0.75	0.60	0.92	1.00
8	3.37	54.00	1.00	1.23	0.73	0.57	0.91	0.98
9	7.60	223.00	1.01	1.26	0.70	0.52	0.90	0.95
10	4.78	111.00	1.01	1.26	0.79	0.68	0.90	0.95
11	3.51	60.00	0.97	1.14	0.77	0.64	0.83	0.77
12	2.97	38.00	0.95	1.08	0.75	0.60	0.77	0.64
13	2.82	32.00	0.95	1.08	0.71	0.54	0.74	0.58
14	2.37	15.00	0.91	0.98	0.70	0.52	0.73	0.57
15	2.21	11.10	0.92	1.00	0.72	0.55	0.71	0.54
16	2.01	7.70	0.87	0.87	0.74	0.58	0.70	0.52
17	1.70	4.80	0.83	0.77	0.74	0.58	0.70	0.52
18	1.98	7.40	0.78	0.66	0.75	0.60	0.70	0.52
19	1.98	7.40	0.74	0.58	0.77	0.64	0.70	0.52
20	1.79	5.50	0.71	0.54	0.79	0.68	0.70	0.52
21	1.68	4.70	0.70	0.52	0.77	0.64	0.69	0.51
22	1.50	3.50	0.75	0.60	0.74	0.58	0.69	0.51
23	1.38	2.90	0.70	0.52	0.74	0.58	0.69	0.51
24	1.20	2.00	0.70	0.52	0.75	0.60	0.68	0.49
25	1.12	1.66	0.70	0.52	0.78	0.66	0.67	0.48
26	1.09	1.54	0.71	0.54	0.80	0.70	0.67	0.48
27	1.07	1.47	0.70	0.52	0.83	0.77	0.67	0.48
28	1.01	1.26	0.69	0.51	0.84	0.80	0.66	0.46
29	1.08	1.51	0.67	0.48	0.85	0.82	0.66	0.46
30	1.76	5.20	0.68	0.49	0.86	0.85	0.65	0.45
31	1.65	4.50	0.68	0.49	.....	.....	0.65	0.45

MONTHLY DISCHARGE of Snake creek near Val Marie, for 1916

(Drainage area 188 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (26-31)	300.00	50.00	175.00	0.931	0.210	2,082
April	300.00	3.80	107.00	0.569	0.630	6,367
May	85.00	0.70	10.90	0.058	0.070	670
June	142.00	2.00	11.60	0.062	0.070	690
July	223.00	1.26	44.00	0.234	0.270	2,705
August	15.30	0.48	1.90	0.010	0.010	117
September	0.85	0.52	0.62	0.003	0.003	37
October	1.00	0.45	0.64	0.003	0.003	39
The period	.....	.....	.....	.....	1.266	12,707

DAILY GAUGE HEIGHT AND DISCHARGE of Snake creek near Val Marie, for 1915

Day	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			4.37	94.00	0.57	0.37	0.92	1.00
2			5.89	155.00	0.57	0.37	0.90	0.95
3			6.87	194.00	0.57	0.37	0.89	0.92
4			5.39	135.00	0.58	0.38	0.88	0.90
5			4.11	84.00	0.59	0.39	0.81	0.72
6			3.50	59.00	0.60	0.40	0.69	0.51
7			3.09	43.00	0.59	0.39	0.65	0.45
8			2.57	22.00	0.59	0.39	0.67	0.48
9			2.12	9.40	0.58	0.38	0.65	0.45
10			1.79	5.50	0.58	0.38	0.63	0.43
11			1.52	3.70	0.58	0.38	0.60	0.40
12			1.32	2.60	0.58	0.38	0.59	0.39
13			1.11	1.62	0.59	0.39	0.59	0.39
14			1.01	1.26	0.62	0.42	0.63	0.43
15			0.99	1.20	0.65	0.45	0.60	0.40
16			0.87	0.87	0.69	0.51	0.57	0.37
17			0.85	0.82	0.67	0.48	0.65	0.45
18			0.82	0.75	0.66	0.46	0.61	0.41
19			0.79	0.68	0.62	0.42	0.62	0.42
20			0.72	0.55	0.59	0.39	0.65	0.45
21			0.72	0.55	0.57	0.37	0.71	0.54
22	1.37	2.8	0.71	0.54	0.59	0.39	0.72	0.55
23	1.42	3.1	0.72	0.55	0.57	0.37	0.75	0.60
24	3.52	60.0	0.72	0.55	0.55	0.35	0.76	0.62
25	3.69	67.0	0.69	0.51	0.54	0.34	0.70	0.52
26	3.37	54.0	0.67	0.48	0.69	0.51	0.67	0.48
27	3.33	53.0	0.65	0.45	0.75	0.60	0.68	0.49
28	3.37	54.0	0.63	0.43	0.75	0.60	0.69	0.51
29	2.92	36.0	0.61	0.41	0.70	0.52	0.68	0.49
30	3.27	50.0	0.61	0.41	0.96	1.11	0.68	0.49
31	4.27	90.0	.....	.....	0.95	1.08	.....	.....

DAILY GAUGE HEIGHT AND DISCHARGE of Snake creek near Val Marie, for 1915.—*Concluded.*

MONTH	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	0.64	0.44	0.57	0.37	0.44	0.24	0.65	0.45
2	0.65	0.45	0.56	0.36	0.45	0.25	0.66	0.46
3	0.65	0.45	0.57	0.37	0.45	0.25	0.75	0.60
4	0.66	0.46	0.57	0.37	0.45	0.25	0.74	0.58
5	0.63	0.43	0.55	0.35	0.45	0.25	0.73	0.57
6	0.61	0.41	0.53	0.33	0.45	0.25	0.70	0.52
7	0.60	0.40	0.51	0.31	0.47	0.27	0.68	0.49
8	0.64	0.44	0.52	0.32	0.51	0.31	0.65	0.45
9	0.62	0.42	0.51	0.31	0.52	0.32	0.65	0.45
10	0.61	0.41	0.50	0.30	0.53	0.33	0.64	0.44
11	0.60	0.40	0.48	0.28	0.56	0.36	0.64	0.44
12	0.59	0.39	0.46	0.26	0.59	0.39	0.64	0.44
13	0.57	0.37	0.47	0.27	0.63	0.43	0.63	0.43
14	0.55	0.35	0.46	0.26	0.66	0.46	0.63	0.43
15	0.58	0.38	0.46	0.26	0.65	0.45	0.62	0.42
16	0.60	0.40	0.46	0.26	0.64	0.44	0.62	0.42
17	0.62	0.42	0.45	0.25	0.65	0.45	0.63	0.43
18	0.79	0.68	0.46	0.26	0.65	0.45	0.63	0.43
19	0.79	0.68	0.47	0.27	0.65	0.45	0.64	0.44
20	0.76	0.62	0.48	0.28	0.64	0.44	0.63	0.43
21	0.73	0.57	0.47	0.27	0.62	0.42	0.64	0.44
22	0.69	0.51	0.47	0.27	0.61	0.41	0.62	0.42
23	0.64	0.44	0.46	0.26	0.61	0.41	0.60	0.40
24	0.63	0.43	0.46	0.26	0.60	0.40	0.60	0.40
25	0.63	0.43	0.45	0.25	0.59	0.39	0.59	0.39
26	0.61	0.41	0.45	0.25	0.59	0.39	0.58	0.38
27	0.60	0.40	0.45	0.25	0.60	0.40	0.58	0.38
28	0.58	0.38	0.44	0.24	0.64	0.44	0.57	0.37
29	0.58	0.38	0.44	0.24	0.65	0.45	0.56	0.36
30	0.59	0.39	0.44	0.24	0.65	0.45	0.57	0.37
31	0.57	0.37	0.44	0.24	.....	.....	0.59	0.39

MONTHLY DISCHARGE of Snake creek near Val Marie, for 1915

(Drainage area 188 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (22-31)	90.00	2.80	47.00	0.250	0.09	932
April	194.00	0.41	27.00	0.144	0.16	1,607
May	1.11	0.34	0.46	0.002	0.00	28
June	1.00	0.37	0.54	0.003	0.00	32
July	0.68	0.35	0.44	0.002	0.00	27
August	0.37	0.24	0.28	0.001	0.00	17
September	0.46	0.24	0.37	0.002	0.00	22
October	0.60	0.36	0.44	0.002	0.00	27
The period	.....	.....	.....	.....	0.25	2,692

BIGBREED CREEK NEAR BUZZARD'S RANCH

Location.—On the SE. ¼ Sec. 15, Tp. 2, Rge. 11, W. 3rd Mer., about one and one-quarter miles from the junction with Frenchman river. During 1915 and 1916 located on NW. ¼ Sec. 3, Tp. 2, Rge. 11, W. 3rd Mer.

Records available.—March 23, 1914, to October 31, 1915. Discharge measurements only during 1916.

Gauge.—Vertical staff; zero elevation maintained at 92.48 during 1916. At former station maintained at 95.42 feet.

Bench-mark.—Permanent iron bench-mark, assumed elevation 100.00 feet.

Channel.—Slightly shifting.

Discharge measurements.—Made with current-meter or weir.

Gauge heights.—No records available during 1916, except engineer's readings during the spring run-off.

Winter flow.—Station not maintained during winter.

Observer.—No observer available during 1916.

DISCHARGE MEASUREMENTS of Bigbreed creek near Buzzard's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 7	J. E. Caughey	35.0	52.95	1.36	2.85	72.00
April 17	do	31.0	43.95	1.47	2.68	65.00
April 21	do	20.0	20.90	1.29	1.81	27.00
May 20	do	12.5	9.05	0.41	1.17	3.70
May 29	do	18.0	16.80	1.08	1.56	18.20
June 20	do	9.5	6.95	0.33	1.04	2.30
Aug. 14	L. B. P. Miles	.....	.....	.....	0.78	0.29*w*
Sept. 10	do	.....	.....	.....	0.27	0.04*w*
Sept. 12	do	.....	.....	.....	0.25	0.03*w*
Sept. 16	do	.....	.....	.....	0.21	0.04*w*
Nov. 18	do	.....	.....	.....	0.58	0.20*wi*

w Discharge determined by using a 24-inch weir.
: Stream frozen over.

DAILY GAUGE HEIGHT AND DISCHARGE of Bigbreed creek near Buzzard's ranch, for 1916

DAY	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	7.68	309	.....	15.0*e*	.....	26.0*e*
2	.....	.....	6.54	252	.....	14.0*e*	.....	25.0*e*
3	.....	.....	5.59	205	.....	13.0*e*	.....	24.0*e*
4	.....	.....	4.60	155	.....	12.0*e*	.....	24.0*e*
5	.....	.....	3.47	99	.....	11.0*e*	.....	24.0*e*
6	.....	.....	3.04*b*	80	.....	10.0*e*	.....	25.0*e*
7	.....	.....	2.91	72*d*	.....	9.0*e*	.....	27.0*e*
8	.....	.....	3.27	90*e*	.....	8.0*e*	.....	30.0*e*
9	.....	.....	3.92	122*e*	.....	7.0*e*	.....	27.0*e*
10	.....	.....	6.80	265*e*	.....	6.0*e*	.....	25.0*e*
11	.....	.....	7.21	285*e*	.....	5.0*e*	.....	24.0*e*
12	.....	.....	8.19	335*e*	.....	4.0*e*	.....	20.0*e*
13	.....	.....	7.20	285*e*	.....	4.0*e*	.....	16.0*e*
14	.....	.....	6.10	230*e*	.....	4.0*e*	.....	12.0*e*
15	.....	.....	5.99	225*e*	.....	4.0*e*	.....	8.0*e*
16	.....	.....	.....	195*e*	.....	3.9*e*	.....	4.0*e*
17	.....	.....	2.68	65*d*	.....	3.8*e*	.....	2.8*e*
18	.....	.....	.....	57*e*	.....	3.7*e*	.....	2.4*e*
19	.....	.....	.....	47*e*	.....	3.7*e*	.....	2.3*e*
20	.....	.....	.....	37*e*	1.17	3.7*d*	1.04	2.3*d*
21	.....	.....	1.81	27*d*	1.16	5.0	.....	.....
22	.....*b*	10	1.70	23	1.15	5.0	.....	.....
23	.....	30	.....	23*e*	1.13	5.0	.....	.....
24	.....	45	.....	22*e*	1.13	5.0	.....	.....
25	.....	50	.....	21*e*	4.20	136.0*e*	.....	.....
26	6.30	100	.....	20*e*	3.00	77.0	.....	.....
27	8.16	250	.....	20*e*	2.15	41.0	.....	.....
28	8.76	363	.....	20*e*	1.80	27.0	.....	.....
29	8.36	343	.....	20*e*	1.56	18.2*d*	.....	.....
30	8.09	330	.....	20*e*	1.80	27.0	.....	.....
31	7.61	305	.....	.....	.....	27.0*e*	.....	.....

b-b Ice conditions; discharge estimated.
d Actual measurements.
e Discharge estimated.

MONTHLY DISCHARGE of Bigbreed creek near Buzzard's ranch, for 1916

MONTH	DISCHARGE IN SECOND-FEET			RUN-OFF
	Maximum	Minimum	Mean	Total in Acre-feet
March (22-31)	363	10.0	183.0	3,621
April	335	20.0	121.0	7,200
May	136	4.0	16.7	1,027
June (1-20)	30	2.3	17.5	696
The period	.....	.....	.....	12,544

LITTLEBREED CREEK NEAR BUZZARD'S RANCH

Location.—On the NW. ¼ Sec. 11, Tp. 2, Rge. 11, W. 3rd Mer., near Coriander post office.

Records available.—March 28, 1914, to October 31, 1915. Discharge measurements and estimated flow during spring run-off in 1916.

Gauge.—Vertical staff; zero elevation has been maintained at 92.82 feet since establishment.

Bench-mark.—Permanent iron bench-mark located on the left bank about sixty feet from the gauge; assumed elevation 100.00 feet.

Channel.—Probably permanent.

Discharge measurements.—Made by current-meter and by weir at low stages.

Winter flow.—This station is not maintained during the winter.

Artificial control.—Mr. Buzzard has a dam about one mile below this station but the flow at the gauge is not affected by this structure.

Observer.—None available during 1916.

DISCHARGE MEASUREMENTS of Littlebreed creek near Buzzard's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 24	J. E. Caughey	17.0	109.00	0.88	5.28	96.00
Mar. 25	do	165.0	74.75	0.84	4.68	63.00
Mar. 27	do	400.0	225.00	1.62	4.78	364.00
Mar. 28	do	420.0	314.65	2.01	6.38	695.00
Mar. 29	do	600.0	290.00	1.42	6.44	482.00
Mar. 30	do	580.0	256.00	1.42	6.20	433.00
Mar. 31	do	530.0	253.50	1.35	6.07	394.00
April 1	do	90.5	139.37	1.32	5.81	244.00
April 3	do	44.0	28.50	1.79	4.84	115.00
April 4	do	14.5	8.47	2.04	4.57	79.00
April 11	do	93.0	95.70	2.34	5.50	292.00
April 14	do	49.5	39.00	2.49	5.13	177.00
April 21	do	18.0	31.40	0.41	2.13	13.00
May 20	do	4.4	3.00	0.50	0.90	1.49
May 29	do	12.0	10.70	0.64	1.75	6.90
June 20	do	.....	.....	.....	0.70	0.33*w*
Aug. 13	L. B. P. Miles	.....	.....	.....	Dry	Nil
Sept. 12	do	.....	.....	.....	"	"
Nov. 18	do	.....	.....	.....	"	"

w Weir measurement.

DAILY GAUGE HEIGHT AND DISCHARGE of Littlebreed creek near Buzzard's ranch, for 1916

DAY	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			5.80	244.0*d*		10.00*e*		5.00*e*
2			5.45	174.0*e*		10.00*e*		5.00*e*
3			4.83	115.0*d*		10.00*e*		4.80*e*
4			4.57	79.0*d*		9.60*e*		4.70*e*
5			4.34	62.0*e*		9.40*e*		5.00*e*
6			3.84	47.0*e*		9.20*e*		7.00*e*
7			3.42	47.0*e*		9.00*e*		8.00*e*
8			3.74	47.0*e*		8.40*e*		8.00*e*
9			4.04	59.0*e*		8.00*e*		7.00*e*
10			4.93	231.0*e*		7.50*e*		6.00*e*
11			5.43	292.0*d*		7.00*e*		5.00*e*
12			6.46	292.0*e*		6.00*e*		4.00*e*
13			5.53	239.0*e*		5.00*e*		3.00*e*
14			5.13	177.0*d*		4.50*e*		2.00*e*
15			4.93	130.0*e*		4.00*e*		1.00*e*
16				60.0*e*		3.00*e*		0.80*e*
17			3.50	46.0*e*		2.00*e*		0.60*e*
18				46.0*e*		1.60*e*		0.40*e*
19				60.0*e*		1.50*e*		0.35*e*
20				30.0*e*	0.90	1.49*d*	0.70	0.33*d*
21			2.13	13.0*d*	0.87	1.27		
22		5.0*e*		13.0*e*	0.81	0.84		
23		15.0*e*		12.0*e*	0.80	0.83		
24	5.28	96.0*e*		12.0*e*	0.80	0.83		
25	4.68	63.0*d*		12.0*e*	5.40	220.00		
26	4.64	275.0*e*		12.0*e*	4.40	81.00		
27	4.77	364.0*d*		11.0*e*	3.30	36.00		
28	6.37	695.0*d*		11.0*e*	2.20	14.00		
29	6.44	482.0*d*		11.0*e*	1.75	6.90		
30	6.19	433.0*d*		10.0*e*	1.70	6.00		
31	6.06	394.0*d*				5.40*e*		

d Actual measurement.
e Discharge estimated.

MONTHLY DISCHARGE of Littlebreed creek near Buzzard's ranch, for 1916

(Drainage area 61 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (22-31)	695.0	5.00	282.0	4.620	1.72	5,592
April	292.0	10.00	86.0	1.410	1.57	5,117
May	220.0	0.83	16.1	0.264	0.30	990
June (1-20)	8.0	0.33	3.9	0.064	0.05	155
The period					3.64	11,854

FRENCHMAN RIVER AT MARTIN'S RANCH

Location.—On the NW. ‡ Sec. 24, Tp. 1, Rge. 11, W. 3rd Mer., about five miles below station at Buzzard's ranch.

Records available.—Two discharge measurements only in 1915, but complete records from March 14 to October 31, 1916.

Gauge.—Vertical staff on right bank just above trail crossing; zero elevation maintained at 91.42 feet.

Bench-mark.—Temporary. Top of wooden peg at fence, 40 feet east of gauge; assumed elevation 100.00 feet.

Discharge measurements.—Made by wading at crossing below gauge or from cable at Buzzard's ranch.

Remarks.—This station was established on September 22, 1915, to take the place of the station at Buzzard's ranch, as an observer could not be obtained at that point.

During the spring break-up in 1916, the engineer made discharge measurements and observations at Buzzard's ranch because there is no cable at this station. The flow at this station was determined by adding the flow of Littlebreed creek and an allowance for local run-off to the flow at Buzzard's ranch.

DISCHARGE MEASUREMENTS of Frenchman river at Martin's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 19	J. E. Caughey	41.0	97.85	2.42	3.92*b*	237
Mar. 21	do	77.0	528.00	1.91	9.63	1,007*x*
Mar. 22	do	97.0	666.50	2.39	11.40	1,592*x*
Mar. 24	do	98.0	689.70	1.88	11.44	1,300*x*
Mar. 25	do	103.0	771.25	1.69	12.21	1,308*x*
Mar. 27	do	102.0	745.55	1.84	11.93	1,369*x*
April 4	do	220.0	1,181.75	2.06	13.98	2,436*x*
April 5	do	115.0	841.75	2.01	12.68	1,694*x*
April 7	do	68.0	309.90	2.58	6.34	799*x*
April 11	do	117.0	813.82	1.95	12.46	1,596*x*
April 12	do	120.0	917.15	2.10	13.35	1,928*x*
April 13	do	117.0	862.35	2.04	12.94	1,759*x*
April 14	do	107.0	733.70	1.94	11.51	1,426*x*
April 17	do	68.0	357.55	2.29	7.21	818*x*
April 21	do	52.0	127.50	2.82	3.01	359*x*
May 22	do	38.5	60.80	1.64	1.61	100
June 20	do	41.0	91.95	2.08	2.32	191
Aug. 13	L. B. P. Miles	40.0	58.80	1.48	1.50	87
Sept. 12	do	46.0	31.45	1.34	1.13	42
Sept. 15	do	45.5	33.17	1.17	1.15	39
Nov. 25	do	45.0	35.10	1.19	1.30*b*	42
Nov. 27	do	43.2	24.72	1.60	0.74*b*	40*x*

b Ice conditions.

x Discharge measured and gauge height observed at old gauging station at Buzzard's ranch on NW. ¼ Sec. 3, Tp. 2, Rge. 11, W. 3rd Mer., and does not include the flow of Littlebreed creek or local run-off.

DAILY GAUGE HEIGHT AND DISCHARGE of Frenchman river at Martin's ranch, for 1916

DAY	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	.....	4,424	2.19	171	4.51	592
2	.....	.....	.....	3,754	2.15	165	4.52	594
3	.....	.....	.....	3,495	2.15	165	4.38	566
4	.....	.....	.....	2,515	2.29	186	3.98	486
5	.....	.....	.....	1,756	2.29	186	3.53	399
6	.....	.....	.....	1,051	2.13	162	3.12	323
7	.....	.....	.....	846	2.02	147	2.84	273
8	.....	.....	.....	703	1.97	140	2.62	237
9	.....	.....	.....b	800	1.95	137	2.40	202
10	.....	.....	8.51	1,392	1.97	140	2.64	240
11	.....	.....	11.43	1,976	1.94	136	3.18	333
12	.....	.....	12.98	2 286	1.90	136	4.48	586
13	.....	.....	13.80	2,450	1.90	136	3 21	339
14	3.80b	100	12 26	2,142	2.04	150	2.58	231
15	5.42	200	11.34	1,958	1.90	130	2.38	199
16	4.82	300	10.64	1,818	1.85	123	2.62	237
17	3.98	300	8.07	1,304	1.81	117	3.72	435
18	3.82	250	6.26	942	1.79	115	3.62	416
19	3.92	237	5 50	790	1.72	106	2.88	280
20	.....	700	5.10	710	1.72	106	2.38	199
21	.....	1,007	4.50	590	1.67	100	2 12	161
22	.....	1,597	3.61	414	1.34	64	2.05	151
23	.....	1,485	3.37	369	1.59	91	2.45	210
24	.....	1,396	3 22	341	1.58	90	2.10	158
25	.....	1,371	2.93	288	3.12	323	2.10	158
26	.....	1,625	2.73	255	4.44	578	1.92	133
27	.....	1,733	2.63	239	4.66	622	1.82	119
28	.....	3,845	2.48	215	4.68	646	1.95	137
29	.....	4,172	2 40	202	3.68	427	3.24	344
30	.....	5,223	2.33	192	3.38	370	5.52	794
31	.....	4,734	.....	.....	3.80	450	.....	.....

b-b Ice conditions; discharge estimated from observations and measurements made by engineer in field at the time.

DAILY GAUGE HEIGHT AND DISCHARGE of Frenchman river at Martin's ranch, for 1916—*Concluded*

Day	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.82	654	2.05	151	1.14	45	1.08	40
2	4.51	592	2.90	283	1.10	42	1.09	41
3	4.34	558	2.65	242	1.10	42	1.12	44
4	7.00	1,090	2.30	187	1.10	42	1.15	46
5	.....	1,190*e*	2.14	164	1.14	45	1.18	48
6	.....	1,390*e*	1.89	129	1.13	44	1.30	60
7	.....	1,270*e*	1.73	108	1.12	44	1.44	74
8	5.76	842	1.62	94	1.11	43	1.40	70
9	.....	1,130*e*	1.52	82	1.22	52	1.36	66
10	.....	1,290*e*	1.46	76	1.26	56	1.37	67
11	.....	1,170*e*	1.52	82	1.20	50	1.34	64
12	5.41	772	1.48	78	1.14	45	1.34	64
13	2.91	285	1.51	81	1.15	46	1.33	63
14	2.34	193	1.44	74	1.14	45	1.34	64
15	2.31	188	1.37	67	1.14	45	1.44	74
16	1.97	140	1.34	64	1.14	45	1.46	76
17	1.86	124	1.32	62	1.14	45	1.46	76
18	2.41	204	1.36	66	1.13	44	1.48	78
19	2.86	276	1.35	65	1.12	44	1.50	80
20	2.59	232	1.32	62	1.10	42	1.54	85
21	2.76	260	1.28	58	1.09	41	1.54	85
22	2.35	194	1.25	55	1.08	40	1.53	84
23	1.88	127	1.24	54	1.06	39	1.48	78
24	1.73	108	1.20	50	1.06	39	1.42	72
25	1.62	94	1.18	48	1.06	39	1.37	67
26	1.57	88	1.18	48	1.08	40	1.39	69
27	1.92	133	1.20	50	1.07	40	1.34	64
28	1.64	97	1.14	45	1.08	40	1.35	65
29	2.66	244	1.16	47	1.08	40	1.35	65
30	5.24	738	1.15	46	1.09	41	1.34	64
31	2.40	202	1.14	45	.....	.....	1.34	64

e Discharge estimated.

MONTHLY DISCHARGE of Frenchman river at Martin's ranch, for 1916

(Drainage area 1,939 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (14-31)	5,223	100	1,682	0.867	0.58	60,035
April	4,424	192	1,341	0.692	0.77	79,799
May	646	64	213	0.110	0.13	13,097
June	794	119	318	0.164	0.18	18,922
July	1,390	88	512	0.264	0.30	31,482
August	283	45	89	0.046	0.05	5,472
September	56	39	44	0.023	0.03	2,618
October	85	40	66	0.034	0.04	4,058
The period	.....	.....	.....	.....	2.08	215,483

MCEACHRAN CREEK AT MCCOY'S RANCH

Location.—On the SW. ¼ Sec. 6, Tp. 1, Rge. 7, W. 3rd Mer., about fifty feet north of Mr. McCoy's house.

Records available.—May 1, 1914 to August 31, 1916.

Gauge.—Vertical staff; zero elevation has been maintained at 89.50 feet since establishment.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.
Channel.—Probably permanent.
Discharge measurements.—Made by wading with current-meter and by weir at low stages.
Winter flow.—Station not maintained during the winter.
Diversion.—There are no diversions from this stream.
Observer.—Alfred McCoy.

DISCHARGE MEASUREMENTS of McEachran creek at McCoy's ranch, for 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 20	J. E. Caughey	8.0	19.10	2.75	1.85	52.00
May 25	do	33.0	40.30	1.74	2.20	70.00
May 26	do	68.0	90.80	2.92	3.00	265.00
June 23	do	3.0	1.07	1.36	0.78	1.45
Aug. 12	L. B. P. Miles				0.30	0.04*w*
Sept. 13	do				0.19	Nil
Nov. 20	do				Dry	"
Nov. 23	do				"	"

w Discharge determined by using a 24-inch weir.

DAILY GAUGE HEIGHT AND DISCHARGE of McEachran creek at McCoy's ranch, for 1916

Day	March		April		May		June		July		August	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			5.94	800.0*be*	1.35	16.00	1.46	21.0	1.25	12.50	0.63	0.65
2			4.74	956.0	1.34	15.60	1.40	18.0	1.25	12.50	0.64	0.70
3			4.04	676.0	1.32	14.80	1.27	13.1	1.22	11.60	0.63	0.65
4			3.29	376.0	1.30	14.00	1.20	11.0	1.18	10.40	0.61	0.55
5			2.56	140.0	1.28	13.40	1.10	8.0	1.10	8.00	0.59	0.47
6			2.52	131.0	1.25	12.50	1.05	6.5	1.00	5.00	0.52	0.26
7			2.69	170.0	1.21	11.30	1.02	5.6	1.00	5.00	0.52	0.26
8			2.59	147.0	1.19	10.70	1.00	5.0	1.00	5.00	0.47	0.14
9			3.04	280.0	1.18	10.40	0.90	3.0	1.80	42.00	0.43	0.06
10			4.26	764.0	1.16	9.80	0.90	3.0	2.05	63.00	0.36	Nil
11			4.56	884.0	1.14	9.20	0.90	3.0	2.00	58.00	0.30	"
12			5.09	1,096.0	1.12	8.60	0.85	2.5	1.90	50.00	0.34	"
13			3.79	576.0	1.05	6.50	0.85	2.5	1.78	41.00	0.35	"
14			3.32	388.0	0.95	4.00	0.85	2.5	1.75	38.00	0.35	"
15			2.64	158.0	0.85	2.50	0.85	2.5	1.68	34.00	0.34	"
16			2.44	116.0	0.80	2.00	0.85	2.5	1.62	29.00	0.34	"
17			2.14	73.0	0.80	2.00		2.5*e*	1.52	24.00	0.34	"
18			2.09	67.0	0.80	2.00	0.85	2.5	1.35	16.00	0.34	"
19			2.22	83.0	0.80	2.00	0.84	2.4	1.05	6.50	0.32	"
20			1.90	50.0	0.80	2.00	0.83	2.3	0.88	2.80	0.32	"
21			1.76	39.0	0.87	2.70	0.83	2.3	0.85	2.50	0.31	"
22			1.64	31.0	0.76	1.60	0.82	2.2	0.78	1.80	0.30	"
23			1.64	31.0	0.72	1.20	0.80	2.0	0.70	1.00	0.28	"
24			1.56	26.0	0.70	1.00	0.82	2.2	0.70	1.00	0.28	"
25			1.48	22.0	2.10	68.00	1.07	7.1	0.65	0.75	0.27	"
26			1.42	19.0	2.92	237.00	1.28	13.4	0.65	0.75	0.27	"
27			1.34	15.6	2.13	72.00	1.15	9.5	0.64	0.70	0.26	"
28	5.00	100*be*	1.33	15.2	1.68	34.00	1.05	6.5	0.64	0.70	0.25	"
29	5.50	200*e*	1.34	15.6	1.55	26.00	1.30	14.0	0.62	0.60	0.24	"
30	5.70	400*e*	1.35	16.0	1.65	32.00	1.32	14.8	0.62	0.60	0.24	"
31	5.70	700*e*			1.53	24.00			0.62	0.60	Dry	Dry

b–b Ice conditions.
e Discharge estimated.

MONTHLY DISCHARGE of McEachran creek at McCoy's ranch, for 1916

(Drainage area 107 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (28-31)	700.00	100.00	350.00	3.270	0.486	2,776.0
April	956.00	15.20	272.00	2.540	2.830	16,185.0
May	237.00	1.00	22.00	0.206	0.238	1,353.0
June	21.00	2.00	6.40	0.060	0.067	381.0
July	63.00	0.60	15.70	0.147	0.170	965.0
August	0.70	Nil	0.12	0.001	0.001	7.0
The period					3.792	21,667.0

Creek dry after August 30.

EAST BRANCH MCEACHRAN CREEK AT MCCOY'S RANCH

Location.—On the NE. ¼ Sec. 6, Tp. 1, Rge. 7. W. 3rd Mer., at McCoy's ranch, one mile above junction with main stream.

Records available.—Station established May 26, 1916; daily gauge heights and two discharge measurements only in 1916.

Gauge.—Vertical metallic staff fastened to a post and firmly braced to right bank 100 feet above a ford; zero elevation of the gauge maintained at 86.68 feet since establishment.

Bench-mark.—Wooden plug, twenty feet south and fifty feet west of the gauge; assumed elevation 100.00 feet.

Channel.—Slightly shifting and liable to growth of vegetation.

Discharge measurements.—Made by wading with current-meter at ordinary stages; by weir at low stages; cannot be gauged in flood stages.

Observer.—Alfred McCoy.

Remarks.—Creek went dry early in August. Only two discharge measurements prior to this date, therefore unable to plot curve and compute daily discharge.

DISCHARGE MEASUREMENTS of East branch of McEachran creek at McCoy's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
May 25	J. E. Caughey	41.0	51.2	2.70	x	138.00
May 26	do	31.0	47.6	1.32	4.14	63.00
June 24	do	7.0	3.7	0.36	2.59	1.32
Aug. 11	L. B. P. Miles					Nil
Sept. 14	do					"
Nov. 23	do					"

x Station established May 26.

DAILY GAUGE HEIGHT, in feet, of East branch of McEachran creek at McCoy's ranch, for 1916

DAY	May	June	July	August
1	.....	2.63	3.02	2.06
2	.....	2.60	3.02	2.06
3	.....	2.58	3.00	2.06
4	.....	2.58	3.00	2.05
5	.....	2.50	2.09	2.05
6	.....	2.57	2.09	2.05
7	.....	2.45	2.07	2.05
8	.....	2.42	2.07	2.45
9	.....	2.40	2.06	2.45
10	.....	2.40	2.06	2.40
11	.....	2.40	2.05	Dry
12	.....	2.42	2.05	"
13	.....	2.43	2.04	"
14	.....	2.45	2.03	"
15	.....	2.45	2.02	"
16	.....	2.44	2.02	"
17	.....	2.44	2.02	"
18	.....	2.42	2.02	"
19	.....	2.40	2.01	"
20	.....	2.40	2.01	"
21	.....	2.40	2.00	"
22	.....	2.45	2.00	"
23	.....	2.45	2.00	"
24	.....	2.40	2.02	"
25	.....	2.40	2.02	"
26	4.14	2.40	2.03	"
27	3.00	2.40	2.03	"
28	2.40	2.45	2.03	"
29	2.20	2.48	2.05	"
30	2.60	3.01	2.05	"
31	2.70	.....	2.06	"

HORSE CREEK NEAR BARNARD, MONTANA, U.S.A.

Location.—About one mile north of Barnard post office on United States unsurveyed land, and about one-quarter mile south of the international boundary.

Records available.—May 1, 1914, to October 31, 1916.

Gauge.—Staff gauge, fastened to a post on the right bank. The elevation of the zero of the gauge has been maintained at 92.54 feet since establishment.

Bench-mark.—Wooden stake driven in the left bank 30 feet from the gauge; assumed elevation 100.00 feet.

Channel.—Probably permanent.

Discharge measurements.—Made by wading with current-meter and by weir at low stages.

Winter flow.—This station is not maintained during the winter.

Observer.—W. J. Harris.

DISCHARGE MEASUREMENTS of Horse creek near Barnard, Montana, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 19	J. E. Caughey	18.5	21.25	1.86	2.43	40.00
May 24	do	5.5	1.45	1.17	0.53	1.70
June 24	do	2.5	0.67	1.72	0.54	1.15
Aug. 12	L. B. P. Miles	.....	.....	.....	0.38	0.10*w*
Sept. 14	do	.....	.....	.....	0.28	0.03*w*
Nov. 20	do	.....	.....	.....	0.33	0.07*wi*
Nov. 22	do	.....	.....	.....	0.68*x*	0.06*wi*

w Discharge determined by using a 24-inch weir.
i Stream frozen over.
x Staff gauge located at new section 65 feet up stream.

DAILY GAUGE HEIGHT AND DISCHARGE of Horse creek near Barnard, Montana, for 1916

DAY	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	.....	200.0*e*	0.94	5.30	0.87	4.50
2	.....	.....	.....	200.0*e*	0.87	4.50	0.84	4.20
3	.....	.....	.....	250.0*e*	0.85	4.30	0.79	3.70
4	.....	.....	.....	260.0*e*	0.76	3.40	0.75	3.30
5	.....	.....	.....	240.0*e*	0.70	2.80	0.72	3.00
6	.....	.....	.....	290.0*e*	0.65	2.40	0.69	2.70
7	.....	.....	.....	320.0*e*	0.63	2.20	0.65	2.40
8	.....	.....	.....	340.0*e*	0.63	2.20	0.64	2.30
9	.....	.....	.....	360.0*e*	0.62	2.20	0.63	2.20
10	.....	.....	.....	364.0*e*	0.61	2.10	0.62	2.20
11	.....	.....	.....	340.0*e*	0.60	2.00	0.60	2.00
12	.....	.....	.....	304.0*e*	0.59	1.92	0.58	1.84
13	.....	.....	.....	184.0*e*	0.58	1.84	0.56	1.68
14	.....	.....	.....	160.0*e*	0.57	1.76	0.54	1.52
15	.....	.....	.....	124.0*e*	0.57	1.76	0.52	1.36
16	.....	.....	.....	124.0*e*	0.57	1.76	0.50	1.20
17	.....	.....	.....	88.0*e*	0.56	1.68	0.50	1.20
18	.....	.....	.....	66.0*e*	0.55	1.60	0.50	1.20
19	.....	.....	2.43*f*	40.0	0.56	1.68	0.49	1.14
20	.....	.....	2.34	37.0	0.54	1.52	0.44	0.84
21	.....	.....	2.25	34.0	0.54	1.52	0.49	1.14
22	.....	.....	2.01	26.0	0.52	1.36	0.50	1.20
23	.....	.....	1.95	25.0	0.52	1.36	0.54	1.52
24	.....	.....	1.91	23.0	0.53	1.70*d*	0.54	1.52
25	.....	.....	1.86	22.0	.....	2.00*e*	0.53	1.44
26	.....	10.0*e*	1.80	21.0	3.50	94.00	0.53	1.44
27	.....	20.0*e*	1.60	16.2	3.00	66.00	0.52	1.36
28	.....	50.0*e*	1.30	10.5	1.40	12.30	0.55	1.60
29	.....	120.0*e*	1.19	8.8	1.09	7.40	0.70	2.80
30	..... *f*	140.0*e*	1.00	6.1	0.95	5.40	1.42	12.70
31	.....	160.0*e*	.....	.....	0.90	4.80	.....	.....

e Discharge estimated; based on field inspection.
f-f Gauge washed out.
d Actual measurement.

DAILY GAUGE HEIGHT AND DISCHARGE of Horse creek near Barnard, Montana, for 1916—*Concluded.*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.90	23.00	0.46	0.96	0.24	0.04	0.25	0.05
2	1.40	12.30	0.41	0.66	0.25	0.05	0.25	0.05
3	1.00	6.10	0.41	0.66	0.25	0.05	0.25	0.05
4	0.90	4.80	0.40	0.60	0.25	0.05	0.26	0.06
5	0.69	2.70	0.40	0.60	0.25	0.05	0.26	0.06
6	0.60	2.00	0.39	0.55	0.25	0.05	0.27	0.07
7	0.51	1.28	0.39	0.55	0.26	0.06	0.26	0.06
8	0.45	0.90	0.38	0.50	0.26	0.06	0.26	0.06
9	0.40	0.60	0.38	0.50	0.27	0.07	0.25	0.05
10	0.39	0.55	0.37	0.45	0.30	0.10	0.25	0.05
11	0.39	0.55	0.37	0.45	0.32	0.20	0.25	0.05
12	0.50	1.20	0.38	0.50	0.33	0.25	0.24	0.04
13	0.55	1.60	0.37	0.45	.....	0.16*e*	0.25	0.05
14	0.52	1.36	0.36	0.40	0.28	0.08	0.25	0.05
15	0.50	1.20	0.35	0.35	0.30	0.10	0.26	0.06
16	0.47	1.02	0.35	0.35	0.29	0.09	0.25	0.05
17	0.45	0.90	0.36	0.40	0.28	0.08	0.25	0.05
18	0.43	0.78	0.35	0.35	0.27	0.07	0.26	0.06
19	0.42	0.72	0.34	0.30	0.26	0.06	0.26	0.06
20	0.41	0.66	0.33	0.25	0.25	0.05	0.27	0.07
21	0.41	0.66	0.32	0.20	0.25	0.05	0.26	0.06
22	0.41	0.66	0.31	0.15	0.25	0.05	0.27	0.07
23	0.40	0.60	0.30	0.10	0.25	0.05	0.27	0.07
24	0.40	0.60	0.29	0.09	0.25	0.05	0.28	0.08
25	0.39	0.55	0.28	0.08	0.24	0.04	0.28	0.08
26	0.39	0.55	0.27	0.07	0.24	0.04	0.29	0.09
27	0.38	0.50	0.26	0.06	0.24	0.04	0.29	0.09
28	0.38	0.50	0.25	0.05	0.25	0.05	0.30	0.10
29	0.50	1.20	0.25	0.05	0.24	0.04	0.29	0.09
30	0.53	1.44	0.24	0.04	0.25	0.05	0.30	0.10
31	0.50	1.20	0.24	0.04	.....	.....	0.30	0.10

e Discharge estimated.

MONTHLY DISCHARGE of Horse creek near Barnard, Montana, for 1916

(Drainage area 71 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (26-31)	160.00	10.00	83.00	1.170	0.26	988
April	364.00	6.10	149.00	2.100	2.34	8,866
May	94.00	1.36	8.00	0.133	0.13	492
June	12.70	0.84	2.40	0.034	0.04	143
July	23.00	0.50	2.30	0.032	0.04	141
August	0.96	0.04	0.35	0.005	0.01	22
September	0.25	0.04	0.07	0.001	0.00	4
October	0.10	0.04	0.06	0.001	0.00	4
The period	.....	.....	.....	.....	2.82	10,660

BOWREY DITCH FROM ROCK CREEK, MONTANA, U.S.A.

Location.—In United States unsurveyed territory near Barnard, Montana.
Records available.—June 1 to August 26, 1914. No records obtainable in 1915 and 1916.
Gauge.—Vertical staff; elevation of zero 96.51 feet.
Bench-mark.—Stake on left bank; assumed elevation 100.00 feet.
Discharge measurements.—By wading.
Observer.—C. W. Bowrey.
Remarks.—Station visited by J. E. Caughey on June 24, 1916, and there was no flow.

ROCK CREEK NEAR BARNARD, MONTANA, U.S.A.

Location.—On SE. ¼ Sec. 10-37N-E.P.M., Montana, U.S.A., about one and one-half mile south of the international boundary.
Records available.—May 1, 1914, to October 31, 1916.
Gauge.—Vertical staff on the right bank of the creek at S. H. Barnard's ranch. For the elevation of the zero of the gauge at former locations see the 1915 report. Gauge was established at present location May 24, 1916; elevation of zero of gauge maintained at 84.07 feet.
Bench-mark.—Wooden plug forty feet south of gauge; assumed elevation 100.00 feet.
Channel.—Fairly permanent.
Discharge measurements.—Made by wading.
Winter flow.—Station not maintained during the winter.
Observer.—S. H. Barnard.
Note.—Gauge was moved because no observer was available at former locations. Present gauging station is below junction with Horse creek.

DISCHARGE MEASUREMENTS of Rock creek near Barnard, Montana, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 19	J. E. Caughey	47.0	123.00	2.54	3.65	312.0*x*
May 24	do	20.0	16.40	1.12	2.40	18.3*g*
June 24	do	23.0	37.60	2.15	3.30	81.0
Aug. 12	L. B. P. Miles	12.0	7.95	0.38	1.95	3.0
Sept. 14	do	14.0	9.55	0.51	1.98	4.9
Nov. 21	do	13.5	7.00	0.49	1.96	3.4*i*

x Gauging made at old station.
g New gauging station established below junction with Horse creek.
i Stream frozen over.

DAILY GAUGE HEIGHT AND DISCHARGE of Rock creek near Barnard, Montana, for 1916

DAY	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	.....	1,000	.....	92	2.65	30.0
2	.....	.....	.....	990	.....	84	2.50	23.0
3	.....	.....	.....	980	.....	84	2.47	21.0
4	.....	.....	.....	900	.....	76	2.46	21.0
5	.....	.....	.....	800	.....	76	2.46	21.0
6	.....	.....	.....	600	.....	68	2.46	21.0
7	.....	.....	.....	700	.....	60	2.46	21.0
8	.....	.....	.....	700	.....	52	2.45	20.0
9	.....	.....	.....	700*b*	.....	52	2.45	20.0
10	.....	.....	.....	802	.....	52	2.43	19.3
11	.....	.....	.....	838	.....	40	2.40	18.0
12	.....	.....	.....	802	.....	40	2.36	16.4
13	.....	.....	.....	694	.....	40	2.36	16.4
14	.....	.....	.....	658	.....	46	2.36	16.4
15	.....	.....	.....	622	.....	46	2.29	13.6
16	.....	.....	.....	442	.....	40	2.28	13.3
17	.....	.....	.....	338	.....	34	2.28	13.3
18	.....	.....	.....	306	.....	30	2.26	12.6
19	.....	.....	.....	352*d*	.....	22	2.23	11.5
20	.....	50*be*	.....	192	.....	18	2.19	10.1
21	.....	60	.....	140	.....	14	2.25	12.2
22	.....	100	.....	140	.....	22	2.30	14.0
23	.....	160	.....	120	.....	22*e*	2.45	20.0
24	.....	160	.....	110	2.40	18*x*	2.46	21.0
25	.....	300	.....	120	2.85	43	2.47	21.0
26	.....	400	.....	120	4.00	147	2.47	21.0
27	.....	700	.....	130	3.30	81	2.49	22.0
28	.....	700	.....	110	2.86	44	2.39	17.6
29	.....	800	.....	110	2.82	41	4.54	198.0
30	.....	1,000	.....	100	2.78	39	4.80	222.0
31	.....	1,000	.....	.....	2.70	34	.....	.....

d Actual measurement of Horse and Rock creeks.
b-b Ice conditions.
e-e Discharge estimated; no observer, only very meagre data available.
x New Gauging station established below junction with Horse creek.

DAILY GUAGE HEIGHT AND DISCHARGE of Rock creek near Barnard, Mountain, for 1916—*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.49	193.0	2.10	7.30	1.79	0.88	1.93	3.0
2	3.10	63.0	2.04	5.50	1.78	0.76	1.93	3.0
3	2.90	48.0	1.98	4.00	1.78	0.76	1.94	3.2
4	2.85	43.0	1.99	4.20	1.78	0.76	1.95	3.4
5	2.57	26.0	1.99	4.20	1.78	0.76	1.96	3.6
6	2.50	23.0	1.98	4.00	1.77	0.64	2.00	4.4
7	2.40	18.0	1.97	3.80	1.77	0.64	2.03	5.2
8	2.35	16.0	1.97	3.80	1.77	0.64	2.05	5.8
9	2.30	14.0	1.96	3.60	1.80	1.00	2.05	5.8
10	2.29	13.6	1.97	3.80	1.85	1.60	2.05	5.8
11	2.39	17.6	1.98	4.00	1.89	2.20	2.05	5.8
12	2.30	14.0	1.95	3.40	1.95	3.40	2.05	5.8
13	2.25	12.2	1.94	3.20	1.97	3.80	2.05	5.8
14	2.22	11.1	1.93	3.00	1.98	4.00	2.01	4.7
15	2.15	8.8	1.91	2.60	1.97	3.80	1.98	4.0
16	2.12	7.9	1.89	2.20	1.96	3.60	1.95	3.4
17	2.10	7.3	1.88	2.10	1.95	3.40	1.95	3.4
18	2.08	6.7	1.86	1.76	1.93	3.00	1.95	3.4
19	2.07	6.4	1.84	1.48	1.90	2.40	1.95	3.4
20	2.07	6.4	1.84	1.48	1.88	2.10	1.96	3.6
21	2.06	6.1	1.84	1.48	1.85	1.60	1.96	3.6
22	2.06	6.1	1.82	1.24	1.86	1.76	1.97	3.8
23	2.06	6.1	1.80	1.00	1.87	1.92	1.98	4.0
24	2.01	4.7	1.80	1.00	1.88	2.10	1.97	3.8
45	1.96	3.6	1.80	1.00	1.89	2.20	1.97	3.8
26	1.97	3.8	1.80	1.00	1.90	2.40	1.96	3.6
27	1.98	4.0	1.83	1.36	1.92	2.80	1.96	3.6
28	1.99	4.2	1.81	1.12	1.92	2.80	1.97	3.8
29	2.00	4.4	1.79	0.88	1.93	3.00	1.97	3.8
30	2.14	8.5	1.78	0.76	1.93	3.00	1.97	3.8
31	2.23	11.5	1.78	0.76	.....	.....	1.96	3.6

MONTHLY DISCHARGE of Rock creek near Barnard, Montana, for 1916

(Drainage area 298 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (20-31)	1,000.0	50.00	452.0	1.520	0.68	10,758
April	1,000.0	100.00	487.0	1.630	1.82	28,979
May	147.0	14.00	50.0	0.168	0.19	3,074
June	222.0	10.10	31.0	0.104	0.12	1,845
July	1,930.0	3.60	20.0	0.067	.....	1,230
August	7.3	0.76	2.6	.....	.....	160
September	4.0	0.64	2.1	.....	.....	125
October	5.8	3.00	4.1	.....	.....	252
The period	.....	.....	.....	.....	2.81	46,423

MISCELLANEOUS DISCHARGE MEASUREMENTS made in Frenchman river drainage basin, in 1916

Date	Engineer	Stream	Location	Width	Area of Section	Mean Velocity	Discharge
				Feet	*Sq. ft.*	*Ft. per sec.*	*Sec.-ft.*
May 10	J. E. Caughey	Blacktail creek	NW. 20-6-23-3				1.53*w*
June 9	do	do	do				1.02*w*
July 10	do	do	do				0.62*w*
Sept. 1	L. B. P. Miles	do	do				0.33*w*
Oct. 13	do	do	do				0.16*w*
Nov. 3	do	do	do				0.25*w*
Mar. 28	J. E. Caughey	Buzzard's ditch	NW. 11-2-11-3	13.0	18.85	3.29	62.00
Mar. 29	do	do	do	13.5	20.80	3.32	69.00
April 4	do	do	do	27.0	23.65	2.62	62.00
April 6	do	do	do	28.0	20.90	2.25	47.00
April 7	do	do	do	26.0	20.00	2.35	47.00
April 8	do	do	do	28.0	21.90	2.14	47.00
April 13	do	do	do	28.0	35.35	2.51	89.00
April 14	do	do	do	28.0	36.45	2.69	98.00
April 17	do	do	do	27.0	22.50	2.04	46.00
May 9	do	Calf creek	SE. 5-8-22-3	3.5	3.00	0.57	1.71
June 7	do	do	do	4.0	2.80	0.52	1.46
July 24	L. B. P. Miles	do	do	3.4	2.38	0.45	1.07
Aug. 29	do	do	do				1.13*w*
May 10	J. E. Caughey	Concrete coulee	NW. 2-7-23-3	3.6	1.32	1.89	2.50
June 8	do	do	do	3.2	1.26	1.20	1.52
July 10	do	do	do				1.44
July 25	do	do	do	2.7	0.78	1.36	1.06
Aug. 31	L. B. P. Miles	do	do				0.72*w*
Nov. 3	do	do	do				1.37*w*
May 10	do	Doyle coulee	SW. 17-7-22-3				0.50*w*
June 8	do	do	do				0.80
July 10	do	do	do				0.27*w*
July 25	do	do	do				0.24*w*
Aug. 31	do	do	do				0.23*w*
Nov. 3	do	do	do				0.43*w*
April 24	J. E. Caughey	E. br. Snake creek	NW. 21-4-12-3	4.0	0.90	0.52	0.47
May 19	do	do	do				Nil
May 31	do	do	do	4.0	1.45	0.76	1.10
June 26	do	do	do				0.04*w*
Aug. 8	L. B. P. Miles	do	do				Nil
Aug. 14	do	do	do				"
Sept. 10	do	do	do				"
Sept. 16	do	do	do				"
Nov. 15	do	do	do				"
May 19	J. E. Caughey	Fireguard creek	SE. 5-3-11-3				
June 26	do	do	do				0.02*w*
Aug. 9	L. B. P. Miles	do	do				Nil
Aug. 14	do	do	do				"
Sept. 10	do	do	do				"
Sept. 16	do	do	do				"
Nov. 15	do	do	do				"
May 30	J. E. Caughey	Little Pinto creek	SE. 2-4-12-3	11.0	6.10	2.23	13.60
June 26	do	do	do				0.08*w*
Aug. 9	L. B. P. Miles	do	do				"
Aug. 14	do	do	do				"
Sept. 10	do	do	do				"
Sept. 16	do	do	do				"
Nov. 15	do	do	do				"
May 10	J. E. Caughey	Petrified coulee	SE. 18-7-22-3				0.28*w*
June 8	do	do	do				0.56*w*
July 10	do	do	do				0.38*w*
July 25	do	do	do				0.18*w*
Aug. 31	L. B. P. Miles	do	do				0.21*w*
Nov. 3	do	do	do				0.28*w*
May 30	J. E. Caughey	Police creek	SW. 30-3-11-3	13.0	7.30	0.84	6.10
June 26	do	do	do				0.08*w*
Aug. 9	L. B. P. Miles	do	do				Nil
Aug. 14	do	do	do				"
Sept. 10	do	do	do				"
Sept. 16	do	do	do				"
Nov. 15	do	do	do				"
June 8	J. E. Caughey	Rose creek	NE. 26-7-22-3				0.94*w*
Oct. 27	L. B. P. Miles	do	do				0.94*w*
May 18	J. E. Caughey	Shotgun creek	NW. 21-4-14-3				Nil
June 1	do	do	do	4.0	3.08	0.43	1.34
June 27	do	do	do				0.06*w*
Aug. 7	L. B. P. Miles	do	do				Nil
Aug. 15	do	do	do				"
Sept. 9	do	do	do				"
Sept. 16	do	do	do				"
Nov. 14	do	do	do				"

w Discharge determined by using a weir.

SWIFTCURRENT CREEK DRAINAGE BASIN

General Description

Swiftcurrent creek rises in the eastern slope of the Cypress hills, follows a northeasterly course for seventy-five miles and then a northerly one for about twenty-five miles and finally empties into the South Saskatchewan river in Township 20, range 13, West of 3rd Meridian.

The only important tributary is Bone creek, which rises in the Cypress hills and joins the Swiftcurrent in Township 10, Range 19, West of 3rd Meridian.

The main stream flows through a valley, two to three hundred feet deep and a mile wide, to within a few miles of its mouth, where it enters sandstone gorge, about five hundred feet deep.

The bench land above the creek is of rolling prairie, broken by innumerable coulees. The soil is a sandy loam. There is very little tree growth along the stream.

The mean annual rainfall at the town of Swift Current is about fifteen inches. This increases slightly at the stream's headwaters. The greatest precipitation occurs during the months of May, June and July. From November to April the stream is frozen over.

There are a number of small irrigation ditches in this drainage basin, and the town of Swift Current and the Canadian Pacific Railway Company take water for domestic and industrial purposes from the creek.

D. H. POLLOCK EAST DITCH FROM SWIFTCURRENT CREEK

Location.—On NW. ¼ Sec. 22, Tp. 7, Rge. 21, W. 3rd Mer., about one-quarter mile from point of intake.

Records available.—Irrigation seasons 1913-16, and a few discharge measurements from 1909-12.

Gauge.—Vertical staff; zero maintained at elevation of 3,048.28 feet during 1915-16.

Bench-mark.—Permanent iron on Swiftcurrent creek; elevation 3,042.77 feet above mean sea-level.

Discharge measurements.—Made with meter or weir.

Observer.—D. H. Pollock.

Remarks.—Ditch used from June 6 to 13, and June 17 to July 8. During period of flow discharge varied from 0.50 to 1.00 second-foot, giving a total run-off of about 45 acre-feet for the period.

DISCHARGE MEASUREMENTS of D. H. Pollock's East ditch from Swiftcurrent creek, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
June 6	J. E. Caughey	2.80	0.86	1.16	0.58	1.00
July 5	do	2.80	0.43	0.74	0.60	0.32
July 19	do					Nil

D. H. POLLOCK WEST DITCH FROM SWIFTCURRENT CREEK

Location.—On NW. ¼ Sec. 22, Tp. 7, Rge. 21, W. 3rd Mer.

Records available.—Discharge measurements taken in the irrigation season of 1913. Gauge heights during the irrigation season of 1914. J. E. Caughey visited this station on July 19, 1916, and reported no flow.

Gauge.—Vertical staff on the north side of the west end of the flume; zero elevation 3,072.92 feet, referred to Canadian Pacific Railway datum.

Bench-mark.—Permanent iron bench-mark situated near the flume; elevation 3,074.89 feet. (Canadian Pacific Railway datum.)

Channel.—Flume.

Discharge measurements.—Made with meter or weir.

Observer.—D. H. Pollock.

Remarks.—Very little, if any, use was made of this ditch during 1916.

SWIFTCURRENT CREEK AT POLLOCK'S RANCH

Location.—On the SW. ¼ Sec. 22, Tp. 7, Rge. 21, W. 3rd Mer.

Records available.—May 18, 1909, to October 31, 1916. Two discharge measurements in 1908.

Gauge.—Vertical staff; elevation of zero 1909-12 maintained at 89.25 feet; 1913-16 maintained at 3,031 52 feet for the wading section and 3,035.27 feet for the gauge at the weir section.

Bench-mark.—Permanent iron bench-mark; elevation 3,042.77 feet above mean sea-level.

Channel.—Sand and gravel.

Discharge measurements.—At high stages by wading; permanent three-foot weir installed in 1914 for measuring the ordinary flow.

Winter flow.—Station not maintained during the winter.

Observer.—D. H. Pollock.

DISCHARGE MEASUREMENTS of Swiftcurrent creek at Pollock's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 1	M. H. French	3.5	6.00	1.54	4.20*c*	9.30
April 11	do	5.0	8.30	1.71	2.59*c*	14.20
May 4	J. E. Caughey	2.7	1.26	1.67	1.70	2.10
May 15	do	2.5	0.96	1.90	1.55	1.82
June 9	do	3.0	1.75	1.77	1.75	3.10
June 14	do	3.0	1.66	1.51	1.74	2.50
July 7	do	3.0	1.31	1.07	1.45	1.40
July 20	do	.....	.....	.....	1.44	1.46*w*
July 22	do	.....	.....	.....	1.39	1.15*w*
July 31	L. B. P. Miles	.....	.....	.....	1.42	1.38*w*
Aug. 24	do	.....	.....	.....	1.32	1.30*w*
Sept. 5	do	.....	.....	.....	1.38	1.30*w*
Sept. 26	do	.....	.....	.....	1.44	1.62*w*
Nov. 6	do	.....	.....	.....	1.48	1.63*w*

w Discharge determined by using a 36-inch weir.
c Gauge heights affected by ice going out.

DAILY GAUGE HEIGHT AND DISCHARGE of Swiftcurrent creek at Pollock's ranch, for 1916

Day	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	6.50*b*	.....	4.20*c*	9.3*d*	1.84	3.30	1.90	3.90
2	6.30	.....	2.86	9.5*e*	1.83	3.30	1.85	3.40
3	6.27	.....	2.62	9.9*e*	1.85	3.40	1.79	3.00
4	6.27	.....	2.58	10.2*e*	1.72	2.60	1.68	2.40
5	6.28	.....	2.24	11.0*e*	1.72	2.60	1.90	3.90
6	6.28	.....	2.15	11.5*e*	1.70	2.50	1.45	1.49
7	6.27	.....	2.10	11.8*e*	1.64	2.20	1.45	1.49
8	6.30	.....	2.02	12.5*e*	1.58	2.00	1.46	1.53
9	6.51	.....	2.08	13.5*e*	1.57	1.92	1.45	1.49
10	6.50	.....	2.65	14.7*e*	1.56	1.89	2.00	4.90
11	6.30	.....	2.59*c*	14.2*d*	1.56	1.89	1.90	3.90
12	6.25	.....	2.58	14.1	1.56	1.89	1.65	2.30
13	6.20	.....	2.58	14.1	1.55	1.85	1.64	2.20
14	5.60	.....	2.62	14.7	1.55	1.85	1.74	2.70
15	5.58	.....	2.58	14.1	1.55	1.85	1.73	2.60
16	5.55	.....	2.58	14.1	1.75	2.70	1.70	2.50
17	5.50	.....	2.53	13.2	1.65	2.30	5.00	55.00
18	5.40	.....	2.51	12.9	1.60	2.00	1.45	1.49
19	5.25	.....	2.45	11.8	1.57	1.92	1.46	1.53
20	5.40	.....	2.43	11.5	1.55	1.85	1.45	1.49
21	5.55	.....	2.35	10.1	1.52	1.74	1.46	1.53
22	5.40	.....	2.13	6.6	1.52	1.74	1.86	3.40
23	4.30	.....	1.94	4.2	1.52	1.74	1.76	2.80
24	4.00	.....	1.91	4.0	1.55	1.85	1.47	1.56
25	3.90	.....	1.82	3.2	2.00	4.90	1.46	1.53
26	3.80	.....	1.82	3.2	1.85	3.40	1.45	1.49
27	4.00	.....	1.84	3.3	2.10	6.20	1.49	1.63
28	4.40	.....	1.86	3.4	2.27	8.80	1.45	1.49
29	4.40	.....	1.87	3.6	2.25	8.40	1.65	2.30
30	4.90	.....	1.85	3.4	2.20	7.70	1.46	1.53
31	4.60*b*	.....	.....	.....	2.00	4.90	.....	.....

b Ice conditions, March 1 to 31; no discharge measurements made during period.
d Actual measurement.
e Discharge estimated.
c–c Gauge heights affected by ice going out.

DAILY GAUGE HEIGHT AND DISCHARGE of Swiftcurrent creek at Pollock's ranch, for 1916
—*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.40	1.36	1.42	1.38	1.35	1.38	1.48	1.62
2	1.36	1.26	1.42	1.46	1.36	1.38	1.60	2.20
3	1.97	4.60	1.41	1.54	1.39	1.46	1.75	3.11
4	2.06	5.70	1.40	1.62	1.40	1.46	2.00	3.60
5	1.70	2.50	1.70	3.60	1.40	1.46	1.70	2.60
6	2.16	7.10	1.42	1.79	1.40	1.46	1.60	1.79
7	1.95	4.30	1.40	1.79	1.40	1.46	1.60	1.79
8	1.85	3.40	1.75	2.63	1.39	1.38	1.52	1.62
9	1.76	2.80	1.60	2.20	1.39	1.38	1.53	1.46
10	1.64	2.20	1.55	1.79	1.38	1.30	1.53	1.23
11	1.58	2.00	1.50	1.38	1.38	1.30	1.53	1.23
12	1.58	2.00	1.47	1.23	1.38	1.30	1.53	1.23
13	1.58	2.00	1.44	1.23	1.38	1.30	1.53	1.23
14	1.56	1.89	1.44	1.23	1.39	1.38	1.54	1.30
15	1.52	1.74	1.43	1.15	1.38	1.30	1.56	1.38
16	1.48	1.60	1.43	1.15	1.38	1 30	1.56	1.38
17	1.58	2.00	1.43	1.15	1.38	1.23	1.56	1.46
18	1.48	1.60	1.42	1.23	1.38	1.23	1.57	1.54
19	1.46	1.53	1.42	1.23	1.38	1.23	1.56	1.46
20	1.44	1.46	1.41	1.15	1.38	1.23	1.54	1.30
21	1.43	1.38	1.41	1.15	1.38	1.23	1.52	1.23
22	1.45	1.38	1.41	1.08	1.38	1.23	1.50	1.23
23	1.43	1.38	1.37	1.15	1.39	1.30	1.49	1.15
24	1.43	1.38	1.35	1.15	1.41	1.38	1.48	1.15
25	1.43	1.38	1.34	1.15	1.42	1.38	1.47	1.15
26	1.60	2.20	1.35	1.15	1.44	1.46	1.47	1.15
27	1.60	2.20	1.35	1.15	1.50	1.62	1.47	1.23
28	1.50	1.79	1.35	1.23	1.49	1.62	1.47	1.23
29	1.70	2.63	1.36	1.23	1.46	1.46	1.48	1.23
30	1.55	1.96	1.35	1.23	1.46	1.46	1.49	1.23
31	1.42	1.38	1.35	1.23	.....	.....	1.49	1.30

MONTHLY DISCHARGE of Swiftcurrent creek at Pollock's ranch, for 1916

(Drainage area 16 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
April	14.70	3.20	9.80	0.614	0.68	583
May	8.80	1.74	3.10	0.194	0.22	191
June	55.00	1.49	4.10	0.256	0.28	244
July	7.10	1.26	2.30	0.144	0.17	141
August	3.60	1.08	1.45	0.091	0.10	89
September	1.62	1.23	1.37	0.086	0.10	82
October	3.60	1.15	1.54	0.096	0.11	95
The period	.....	.....	.....	.....	1.66	1,425

MEAN MONTHLY DISCHARGE in Second-feet of Swiftcurrent creek at Pollock's ranch

MONTH	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	1.38	1.51	1.54	1.47	1.76	1.40	1.54	1.51	93
November	.....	.....	1.80*b*	1.90*e*	.....	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
March	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
April	2.30	.....	19.00*c*	4.10	3.10	3.60*d*	9.80	.....	4.80	272
May	0.62	1.98*a*	3.80	1.83	1.58	2.40	3.10	.....	2.20	137
June	0.90	1.32	1.62	1.26	0.94	1.90	4.10	.....	1.72	102
July	0.57	0.91	0.77	1.00	0.60	1.40	2.30	.....	1.08	66
August	0.73	0.90	1.16	1.30	1.24	1.50	1.45	.....	1.18	73
September	1.11	1.40	1.34	1.12	1.40	1.40	1.37	.....	1.31	78
Total in acre-ft.	372	469	1,548	735	621	837	1,416	.....	.....	821

a 4-31.
b 1-6.
c 7-30.
d 2-30.
e 1-15.
Drainage areas 12 square miles 1910.
Drainage areas 16 square miles 1911.
Drainage areas 16 square miles 1913.
Drainage areas 16 square miles 1914.

AXTON DITCH FROM SWIFTCURRENT CREEK

Location.—On NE. ¼ Sec. 26, Tp. 7, Rge. 21, W. 3rd Mer., near South Fork post office.
Records available.—Gauge heights for the period June 10 to July 9, 1914.
Gauge.—Vertical staff; zero elevation 3,014.01 feet.
Bench-mark.—Iron bench-mark; elevation 3,015.96 feet.
Observer.—J. W. E. Axton.
Remarks.—With the exception of some natural flooding in the spring, no water was diverted on to the land during 1915 and 1916.

JONES CREEK AT STEARNS' RANCH

Location.—On SE. ¼ Sec. 20, Tp. 8, Rge. 20, W. 3rd Mer.
Records available.—May 15, 1912, to September 12, 1915. Discharge measurements only in 1916.
Gauge.—Vertical staff; zero maintained at elevation of 93.14 since establishment.
Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.
Channel.—Composed of clay and sand.
Discharge measurements.—Made by wading with current-meter or with a weir.
Winter flow.—Station not maintained during winter.
Observer.—No observer available in 1916.

DISCHARGE MEASUREMENTS of Jones creek at Stearns' ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 11	M. H. French	9.0	12.20	1.20	2.81	14.70
May 4	J. E. Caughey	5.7	7.80	0.92	1.75	7.20
June 6	do	7.5	12.10	0.95	.....	11.50
June 15	do	5.4	5.49	1.11	1.35	6.10
July 5	do	5.2	3.09	1.41	0.96	4.40
Aug. 24	L. B. P. Miles	.....	.....	.....	0.58	0.67*w*
Sept. 6	do	.....	.....	.....	.....	0.81*w*

w Discharge measurement made by using a 24-inch weir.

STEARNS BROS. SOUTH DITCH NEAR LEITCHVILLE

Location.—On SW. ¼ Sec. 9, Tp. 9, Rge. 20, W. 3rd Mer.
Gauge.—Vertical staff just above weir. Elevation of zero of gauge maintained at 110.83 feet since establishment. Elevation of crest of weir maintained at 111.39 ft. since establishment.
Bench-mark.—One bench-mark used for both north and south ditches; seven-eighths inch iron pin located four feet to the right and two feet above the weir in the north ditch; assumed elevation 100.00 feet.
Channel.—One; heavy loam bed
Discharge measurements.—Made by a weir.
Observers.—Stearns Bros.
Remarks.—This station was established on July 21, 1915. No records were obtained in 1915 or 1916, and it is believed that very little, if any, water was diverted during 1916.

STEARNS BROS. NORTH DITCH NEAR LEITCHVILLE

Location.—On NW. ¼ Sec. 9, Tp. 9, Rge. 20, W. 3rd Mer.
Gauge.—Vertical staff just above weir; elevation of zero maintained at 98.67 feet since establishment; elevation of crest of weir maintained at 99.14 feet since establishment.
Bench-mark.—Seven-eighths-inch iron pin, located four feet to the right and two feet above the weir; assumed elevation 100.00 feet.
Channel.—One, heavy loam bed.
Discharge measurements.—Made by a weir.
Observers.—Stearns Bros.
Remarks.—This station was established July 21, 1915. No records were obtained in 1915 or 1916. It is believed that very little, if any, water was diverted during 1916.

STEARNS DITCH NEAR DOLLARD

Location.—On the SW. ¼ Sec. 20, Tp. 8, Rge. 20, W. 3rd Mer., 600 feet from headgate of ditch.
Records available.—Discharge measurements only in 1914.
Gauge.—Vertical staff, graduated to feet and inches; elevation 97.46 feet.
Bench-mark.—Top of stake, marking initial point for soundings; assumed elevation 100.00 feet.
Discharge measurements.—Made with weir.
Observer.—C. E. Stearns.
Remarks.—This station was visited on July 5, 1916, but there was no flow. It is understood that very little water was diverted during 1915 and 1916.

SINCLAIR SOUTH DITCH NEAR GULL LAKE

Location.—On SE. ¼ Sec. 18, Tp. 10, Rge. 19, W. 3rd Mer.
Gauge.—Vertical staff, situated on the right side of the ditch and 300 feet below the headgate; zero elevation maintained at 97.72 feet since establishment; elevation of crest of weir maintained at 98.32 feet since establishment.
Bench-mark.—Permanent iron bench-mark, four feet to the right and two feet above the weir; assumed elevation 100.00 feet.
Channel.—One channel at all stages, clay loam bed.
Discharge measurements.—Made by a weir.
Observer.—K. Sinclair.
Remarks.—This station was established on July 22, 1915. No records were obtained in 1915 or 1916. It is understood that some water was used in 1915, but very little, if any, was diverted during 1916.

SWIFTCURRENT CREEK (UPPER STATION) AT SINCLAIR'S RANCH

Location.—On the NE. ¼ Sec. 18, Tp. 10, Rge. 19, W. 3rd Mer., above the mouth of Bone creek.
Records available.—Open water flow, June 15, 1910, to October 31, 1916.
Gauge.—Vertical staff; zero was maintained at 87.91 feet during 1910-11 and 87.86 feet during 1912-16.
Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.
Channel.—Permanent.
Discharge measurements.—Made with meter, and by weir at low stages.

Winter flow.—This station is not maintained during the winter.

Diversions.—Messrs. D. H. Pollock and J. W. E. Axton divert water for irrigation purposes above this station.

Observer.—Mrs. K. Sinclair.

Remarks.—Records at this station are affected by backwater from Bone creek at certain stages of that stream.

DISCHARGE MEASUREMENTS of Swiftcurrent creek at Sinclair's ranch (Upper Station), in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 12	M. H. French	10.0	35.40	1.61	3.42	57.0
May 4	E. J. Switzer	14.5	12.50	1.48	1.23	18.5
June 7	do	18.2	21.20	0.88	1.90	18.6*c*
July 11	do	15.1	9.39	1.45	1.26	13.6
Aug. 5	do	12.4	5.15	0.67	0.82	3.4
Sept. 30	do	12.0	6.50	0.67	1.90	4.4*c*
Nov. 6	do	11.3	5.52	1.14	1.98	6.3*c*

c Measurement affected by backwater caused by beaver dams below gauge.

DAILY GAUGE HEIGHT AND DISCHARGE of Swiftcurrent creek at Sinclair's ranch (Upper Station), for 1916

Day	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			4.67	96	1.30	31.0	2.27	44.0
2			4.06	74	1.30	21.0	2.02	35.0
3			3.77	64	1.29	19.5	2.01	32.0
4			3.62	58	1.23	18.5	1.91	30.0
5			3.42	55	1.19	17.7	1.92	29.0
6			3.34	52	1.16	16.7	2.62	50.0
7			3.29	51	1.14	16.3	1.90	18.6
8			3.25	51	1.13	16.3	1.90	17.5
9			3.22	51	1.09	16.0	1.82	15.0
10			3.21	52	0.99	15.7	1.84	16.0
11			3.21	54	0.98	15.5	3.86	78.0
12			3.42	57	0.98	16.0	3.49	48.0
13			3.34	56	0.96	17.5	2.14	42.0
14			3.07	55	0.95	20.0	2.04	38.0
15			2.84	52	0.99	26.0	1.93	34.0
16			2.72	48	1.99	34.0	1.89	30.0
17			2.57	40	1.67	40.0	1.84	24.0
18			2.41	34	1.29	32.0	1.81	18.7
19			2.28	32	1.24	25.0	1.77	15.0
20			2.12	30	1.22	19.0	1.73	13.5
21			1.94	28	1.20	17.0	1.76	15.0
22			1.80	27	1.11	16.2	1.95	19.5
23	6.97	200	1.71	27	1.08	14.5	2.06	28.0
24	7.07	200	1.53	27	1.01	11.5	1.76	24.0
25	7.87	180	1.46	27	1.26	10.0	1.75	23.0
26	7.86	165	1.42	28	1.31	40.0	1.65	23.0
27	6.57	152	1.38	29	4.51	100.0	1.61	21.0
28	6.07	143	1.39	30	3.90	80.0	1.55	18.0
29	5.27	124	1.41	32	3.26	61.0	1.45	15.7
30	4.97	116	1.45	33	2.61	56.0	1.40	15.0
31	4.82	109			2.57	50.0		

DAILY GAUGE HEIGHT AND DISCHARGE of Swiftcurrent creek at Sinclair's ranch (Upper Station), for 1916—*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.36	16.0	0.89	8.0	0.78	4.8	1.60	4.0
2	1.41	20.0	0.89	7.0	0.78	5.3	1.93	4.5
3	2.46	37.0	0.88	5.8	0.79	5.7	1.92	20.0
4	2.05	30.0	0.87	4.6	0.80	6.4	2.28	28.0
5	1.81	28.0	0.82	3.4	0.83	7.0	2.03	30.0
6	2.06	33.0	0.79	3.5	0.80	6.4	2.38	30.0
7	1.61	21.0	0.78	3.8	0.78	6.0	2.35	28.0
8	1.55	20.0	0.76	5.2	0.77	5.8	1.93	14.0
9	1.54	19.0	0.93	13.0	0.78	5.7	1.92	13.5
10	1.51	15.6	1.48	19.0	0.79	5.9	1.90	13.1
11	1.26	13.6	0.93	13.0	0.77	6.0	1.93	13.1
12	1.19	10.0	0.91	9.8	1.60	6.0	2.03	13.1
13	1.10	7.3	0.83	8.9	1.25	6.0	1.92	12.8
14	1.17	7.0	0.82	7.6	1.13	6.2	1.91	12.3
15	1.12	8.0	0.80	6.1	0.98	6.5	1.88	11.5
16	1.08	7.9	0.78	5.4	1.00	6.4	1.93	10.8
17	1.05	7.7	0.73	4.9	0.93	6.2	1.91	10.4
18	1.00	7.0	0.70	4.6	0.98	5.8	1.83	10.1
19	0.97	3.3	0.65	4.4	1.03	5.5	1.82	9.7
20	0.98	6.0	0.63	4.2	1.02	5.5	1.78	9.1
21	0.97	5.8	0.62	4.0	1.05	5.6	1.77	8.7
22	0.96	5.7	0.60	3.8	1.28	5.6	1.75	8.5
23	0.95	5.5	0.58	3.8	1.33	6.4	1.82	8.0
24	0.93	5.5	0.58	3.8	1.20	6.0	1.83	7.0
25	0.88	6.0	0.57	3.7	1.28	4.7	1.81	5.9
26	0.91	10.0	0.59	3.7	1.29	5.0	1.79	5.0
27	1.06	14.0	0.58	3.6	1.25	4.9	1.92	5.2
28	0.95	12.0	0.61	3.7	1.43	4.5	1.90	6.2
29	0.93	11.2	0.62	3.7	1.65	4.5	1.88	6.5
30	0.92	10.6	0.65	4.0	1.74	4.4	1.86	6.5
31	0.93	10.0	0.66	4.3	.....	.....	1.84	6.4

Owing to backwater from beaver dams below the gauge the daily discharge was determined from hydrograph.

MONTHLY DISCHARGE of Swiftcurrent creek at Sinclair's ranch (Upper Station), for 1916

(Drainage area 172 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (23-31)	200	109.0	154.0	0.895	0.30	2,748
April	96	27.0	45.0	0.262	0.29	2,678
May	100	10.0	29.0	0.169	0.19	1,783
June	78	13.5	28.0	0.163	0.18	1,666
July	37	3.3	13.3	0.077	0.09	818
August	19	3.4	5.9	0.034	0.04	363
September	7	4.4	5.7	0.033	0.04	339
October	30	4.0	12.0	0.070	0.08	738
The period	.....	.....	.....	.....	1.21	11,133

MEAN MONTHLY DISCHARGE in Second-feet of Swiftcurrent creek at Sinclair's ranch (Upper Station)

MONTH	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	1.81	5.2	4.40	3.40	9.4	3.5	12.0	5.7	349
November	.....	.....	.....	6.50*c*	.....	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
March	.....	.....	.....	.....	.....	.....	154.0*h*	.....	.....	.....
April	.....	.....	.....	97.00*d*	44.00	15.0*f*	45.0	.....	44.0	2,636
May	.....	13.80*b*	.....	12.00	5.70	25.0	29.0	.....	17.9	1,103
June	2.20*a*	5.50	3.4*e*	8.10	4.40	23.0	28.0	.....	13.8	821
July	0.98	3.60	4.0	2.80	0.56	14.4	13.3	.....	5.7	348
August	0.35	1.47	3.2	0.96	0.43	2.2	5.9	.....	2.1	128
September	1.69	12.80	3.4	0.99	5.30	3.1	5.7	.....	4.7	281
Total in acre-ft.	255	2,142	985	6,391	3,798	5,220	10,611	.....	.....	5,666

a 15-30.
b 9-31.
c 1-15.
d 8-30.
e 28-30.
f 13-30.
h 23-31.

LEWIS DITCH AT KLINTONEL

Location.—On NW. ¼ Sec. 34, Tp. 8, Rge. 22, W. 3rd Mer., about one thousand feet below the headgate.

Records available.—August 20, 1915, to September 11, 1915.

Gauge.—Staff fastened to a post at the left bank; zero elevation maintained at 94.25 feet since establishment.

Bench-mark.—Permanent iron bench-mark on the right bank about eight feet southeast of the gauge; assumed elevation 100.00 feet.

Discharge measurements.—Made by current-meter at the section, or by weir in the ditch.

Observer.—C. L. Lewis.

Remarks.—This ditch takes its supply from a spring which enters Bone creek above the gauging station, on that stream. It is understood that no water was diverted during 1916.

BONE CREEK AT LEWIS' RANCH

Location.—On the NW. ¼ Sec. 34, Tp. 8, Rge. 22, W. 3rd Mer., at Klintonel post office.

Records available.—July 1, 1908, to October 31, 1916.

Gauge.—Vertical staff; the elevation of the zero has been maintained at 95.02 feet since establishment.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—Slightly shifting.

Discharge measurements.—Made with current-meter or with weir at low stages.

Winter flow.—This station is not maintained during the winter.

Observer.—C. L. Lewis.

Remarks.—About one second-foot flowing during first part of November.

DISCHARGE MEASUREMENTS of Bone creek at Lewis' ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
May 9	J. E. Caughey	5.1	1.90	1.16	0.27	2.20
June 7	do	5.4	3.04	0.71	0.27	2.20
July 24	do	6.2	2.71	0.39	0.18	1.05
Aug. 30	L. B. P. Miles	.....	.....	.....	0.22	1.33*w*
Oct. 27	do	.....	.....	.....	0.29	2.60*e*

e Discharge estimated.
w Discharge determined by using an 18-inch weir.

DAILY GAUGE HEIGHT AND DISCHARGE of Bone creek at Lewis' ranch, for 1916

Day	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft*
1	0.60	.....*i*	0.53	7.4	0.30	2.80	0.29	2.60
2	0.60	.....	0.43	5.4	0.29	2.60	0.26	2.00
3	0.59	.....	0.44	5.6	0.28	2.40	0.26	2.00
4	0.59	.....	0.35	3.8	0.30	2.80	0.25	1.80
5	0.58	.....	0.34	3.6	0.28	2.40	0.38	4.40
6	0.58	.....	0.34	3.6	0.28	2.40	0.31	3.00
7	0.58	.....	0.34	3.6	0.29	2.60	0.27	2.20
8	0.60	.....	0.36	4.0	0.26	2.00	0.25	1.80
9	0.65	.....	0.64	9.6	0.27	2.20	0.25	1.80
10	0.68	.....*i*	0.65	9.8	0.27	2.20	0.31	3.00
11	3.95*g*	.....	0.55	7.8	0.27	2.20	0.51	7.00
12	1.97	.....	0.45	5.8	0.27	2.20	0.33	3.40
13	0.95	.....	0.67	10.2	0.26	2.00	0.27	2.20
14	0.52	.....	0.50	6.8	0.27	2.20	0.25	1.80
15	0.43	.....	0.45	5.8	0.27	2.20	0.25	1.80
16	0.43	.....	0.34	3.6	0.35	3.80	0.26	2.00
17	0.43	.....	0.32	3.2	0.27	2.20	0.27	2.20
18	0.43	.....	0.39	4.6	0.26	2.00	0.26	2.00
19	0.50*g*	.....	0.34	3.6	0.25	1.80	0.24	1.67
20	1.56	28.0	0.31	3.0	0.26	2.00	0.24	1.67
21	1.86	34.0	0.30	2.8	0.26	2.00	0.24	1.07
22	0.95	15.8	0.30	2.8	0.26	2.00	0.34	3.60
23	0.75	11.8	0.29	2.6	0.34	3.60	0.29	2.60
24	0.52	7.2	0.29	2.6	0.29	2.60	0.28	2.40
25	0.51	7.0	0.29	2.6	0.40	4.80	0.26	2.00
26	0.56	8.0	0.29	2.6	0.48	6.40	0.24	1.67
27	0.60	8.8	0.29	2.6	0.47	6.21	0.23	1.54
28	0.67	10.2	0.33	3.4	0.57	8.20	0.23	1.54
29	0.60	8.8	0.32	3.2	0.36	4.00	0.28	2.40
30	0.55	7.8	0.29	2.6	0.32	3.20	0.26	2.00
31	0.53	7.4	.....	.....	0.34	3.60	.....	.....

i Stream frozen over.
g Ice going out.
No discharge records available, March 1 to 19.

DAILY GAUGE HEIGHT AND DISCHARGE of Bone creek at Lewis' ranch, for 1916.—*Concluded.*

Day	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	0.25	1.80	0.19	1.10	0.20	1.16	0.24	1.67
2	0.20	1.16	0.22	1.42	0.19	1.10	0.26	2.00
3	0.35	3.80	0.22	1.42	0.30	2.80	0.26	2 00
4	0.23	1.54	0.22	1.42	0.21	1.29	0.27	2 20
5	0.21	1.29	0.20	1.16	0.21	1.29	0.27	2.20
6	0.20	1.16	0.23	1.54	0.25	1.80	0.29	2.60
7	0.21	1.29	0.23	1.54	0.23	1.54	0.30	2.80
8	0.22	1.42	0.20	1.16	0.22	1.42	0.28	2.40
9	0.19	1.10	0.27	2.20	0.24	1.67	0.27	2 20
10	0.18	1.05	0.26	2.00	0.22	1.42	0.30	2.80
11	0.18	1.05	0.25	1.80	0.22	1.42	0.30	2.80
12	0.17	0.99	0.22	1.42	0.23	1.54	0.27	2 20
13	0.17	0.99	0.21	1.29	0 24	1.67	0 26	2.00
14	0.17	0.99	0.23	1.54	0.23	1.54	0 25	1.80
15	0.18	1.05	0.23	1.54	0.23	1.54	0.25	1.80
16	0.16	0.94	0.22	1.42	0.22	1.42	0.24	1.67
17	0.17	0.99	0.21	1.29	0.21	1.29	0.25	1.80
18	0.23	1.54	0.21	1.29	0.21	1.29	0 25	1.80
19	0.19	1.10	0.20	1.16	0 20	1.16	0.25	1.80
20	0.18	1.05	0.20	1.16	0.20	1.16	0.26	2.00
21	0.18	1.05	0.23	1.54	0.21	1.29	0.26	2.00
22	0.20	1.16	0.23	1.54	0.21	1.29	0.25	1.80
23	0.18	1.05	0.23	1.54	0.22	1.42	0.25	1.80
24	0.18	1.05	0.22	1.42	0 22	1.42	0.25	1.80
25	0.16	0.94	0.22	1.42	0.22	1.42	0.25	1.80
26	0.29	2.60	0.22	1.42	0.23	1.54	0.25	1.80
27	0.32	3.20	0.21	1.29	0.36	4.00	0.25	1.80
28	0.23	1.54	0.20	1.16	0.26	2.00	0 29	2.60
29	0.26	2.00	0.20	1.16	0.24	1.67	0.25	1.80
30	0.21	1.28	0.22	1.42	0.24	1.67	0.24	1.67
31	0.20	1.16	0.20	1.16			0.24	1.67

MONTHLY DISCHARGE of Bone creek at Lewis' ranch, for 1916

(Drainage area 17 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (20-31)	34.0	7.00	12.90	0.759	0.34	307
April	10.2	2.60	4.60	0.271	0.30	274
May	8.2	1.80	3.00	0.176	0.20	184
June	7.0	1.07	2.40	0.141	0.16	143
July	3.8	0.94	1.39	0.082	0.09	85
August	2.2	1.10	1.42	0.084	0.10	87
September	4.0	1.10	1.57	0.092	0.10	93
October	2.8	1.67	2.00	0.118	0.14	123
The period					1.43	1,296

MONTHLY DISCHARGE in Second-feet of Bone creek at Lewis' ranch

MONTH	1907–8	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	6.50	1.45	1.47	1.57	1.56	1.44	1.55	1.97	2.00	2.20	133
November	.....	.....	.....	.....	1.23*h*	1.41*d*	.....	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
March	.....	6.40*a*	.....	16.70*b*	.....	.....	8.20*e*	0.83*f*	12.90*g*	.....	.....	.....
April	.....	5.90	2.50	23.00	35.00	15.80*c*	5.90	4.90	4.60	.....	11.70	694
May	.....	6.10	2.40	2.50	5.70	2.80	2.70	2.10	3.00	.....	3.40	211
June	.....	6.50	2.20	1.95	2.90	2.20	1.30	2.20	2.40	.....	2.70	161
July	1.67	2.60	1.15	1.29	2.00	1.36	0.54	1.50	1.39	.....	1.50	92
August	2.20	1.48	1.34	1.26	1.61	1.12	0.54	0.87	1.42	.....	1.32	81
Sept.	1.82	1.51	1.50	2.50	1.82	1.24	1.16	1.37	1.57	.....	1.61	96
Total in Acre-feet	344	1,932	759	2,250	3,073	1,516	1,143	907	1,294	.....	.....	1,468

a 26-31.
b 25-31.
c 4-30.
d 1-15.
e 12-31.
f 12-31.
g 20-31.
h 1-11.

SWIFTCURRENT CREEK AT SINCLAIR'S RANCH (LOWER STATION)

Location.—On the NW. ¼ Sec. 17, Tp. 10, Rge. 19, W. 3rd. Mer., and below the mouth of Bone creek.

Records available.—Open water flow from May 27, 1910, to October 31, 1916.

Gauge.—Chain gauge, attached to floor of highway bridge; the zero of the gauge was maintained at 85.73 feet during 1913-16.

Bench-mark.—Permanent iron bench-mark located on the right bank about six hundred feet up stream from the bridge; assumed elevation 100.00 feet.

Channel.—Permanent.

Discharge measurements.—Made with current-meter from bridge or by wading, and with a weir at very low stages.

Winter flow.—This station is not maintained during the frozen season.

Observer.—Mrs. K. Sinclair.

DISCHARGE MEASUREMENTS of Swiftcurrent creek at Sinclair's ranch (Lower Station), in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 12	M. H. French	25.0	89.50	1.95	3.05	175.0
May 4	E. J. Switzer	19.0	45.10	1.07	2.89	48.0
June 7	do	20.5	60.63	1.25	3.64	76.0
July 11	do	18.5	43.30	0.80	2.92	35.0
Aug. 5	do	18.1	32.54	0.42	2.36	13.7
Sept. 30	do	18.3	36.56	0.57	2.72	21.0
Nov. 6	do	18.0	34.80	0.63	2.61	22.0

DAILY GAUGE HEIGHT AND DISCHARGE of Swiftcurrent creek at Sinclair's ranch (Lower Station), for 1916

DAY	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	7.57	415	3.08	43.0	4.21	114
2	.....	.....	6.95	390	3.06	42.0	4.18	112
3	.....	.....	6.67	340	2.99	39.0	4.13	109
4	.....	.....	5.57	200	2.89	34.0	3.96	97
5	.....	.....	5.00*b*	171	2.84	31.0	3.79	86
6	.....	.....	5.02	172	2.83	31.0	4.74	152
7	.....	.....	4.65	146	2.80	30.0	3.64	76
8	.....	.....	4.30	121	2.78	29.0	3.60	74
9	.....	.....	4.13	109	2.64	23.0	3.56	71
10	.....	.....	3.97	98	2.59	21.0	3.66	77
11	.....	.....	4.03	102	2.58	21.0	5.87	234
12	.....	.....	5.05	175	2.57	20.0	4.43	130
13	.....	.....	5.15	182	2.55	19.5	3.48	66
14	.....	.....	4.95	167	2.50	17.8	3.46	65
15	.....	.....	4.87	162	2.91	35.0	3.30	55
16	.....	.....	4.65	146	4.28	119.0	3.26	53
17	.....	.....	4.27	119	3.35	58.0	3.23	51
18	.....	.....	3.95	96	3.00	39.0	3.18	48
19	.....	.....	3.87	91	2.93	36.0	2.96	37
20	.....	.....	3.80	87	2.90	34.0	2.95	37
21	.....	.....	3.61	74	2.84	31.0	2.97	38
22	.....	.....	3.43	63	2.80	30.0	3.51	68
23	.....	.....	3.32	56	2.77	28.0	3.68	79
24	8.85*b*	590	3.29	55	2.75	27.0	3.16	47
25	8.80	580	3.18	48	2.90	34.0	3.17	48
26	8.60	560	3.11	45	3.96	97.0	3.16	47
27	8.45	530	3.01	40	6.47	277.0	3.13	46
28	8.25	500	3.02	40	5.52	208.0	3.15	47
29	7.95	460	3.11	45	4.89	163.0	3.12	45
30	7.75	430	3.13	46	4.62	144.0	3.10	44
31	7.65	420	.....	.....	4.60	142.0	.....	.....

b-b Ice conditions. Discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of Swiftcurrent creek at Sinclair's ranch (Lower Station), for 1916.—*Concluded.*

Day	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.04	42.0	2.69	25.0	2.41	15.0	2.79	29 0
2	3.09	44.0	2.64	23.0	2.43	15.6	2.95	37.0
3	4.14	110.0	2.51	18.1	2.42	15.3	3.31	56.0
4	3.76	84.0	2.49	17.5	2.40	14.7	3.84	89.0
5	3.67	78.0	2.36	13.6	2.61	22.0	3.88	92.0
6	3.99	99.0	2.35	13.3	2.46	16.5	3.91	94.0
7	3.27	53.0	2.34	13.1	2.45	16.2	3.73	82.0
8	2.94	36.0	2.34	13.1	2.43	15.6	2.96	37.0
9	2.93	36.0	2.95	37.0	2.41	15.0	2.95	37.0
10	2.91	35.0	3.31	56.0	2.44	15.9	2.85	32.0
11	2.92	35.0	2.94	36.0	2.42	15.3	2.63	22.0
12	2.79	29.0	2.79	29.0	2.41	15.0	2.56	19.9
13	2.66	24.0	2.75	27.0	2.43	15.6	2.41	15.0
14	2.63	22.0	2.55	19.5	2.45	16.2	2.26	11.3
15	2.52	18.5	2.47	16.8	2.46	16.5	2.23	10.7
16	2.44	15.9	2.45	16.2	2.47	16.8	2.15	9.4
17	2.32	12.6	2.41	15.0	2.45	16.2	2.31	12.3
18	2.26	11.3	2.36	13.6	2.46	16.5	2.46	16.5
19	2.32	12.6	2.33	12.8	2.44	15.9	2.54	19.2
20	2.34	13.1	2.28	11.7	2.42	15.3	2.67	24.0
21	2.40	14.7	2.26	11.3	2.42	15.3	2.65	23.0
22	2.41	15.0	2.25	11.1	2.44	15.9	2.46	16.5
23	2.38	14.1	2.23	10.7	2.46	16.5	2.43	15.6
24	2.35	13.3	2.22	10.6	2.45	16.2	2.42	15.3
25	2.32	12.6	2.21	10.4	2.46	16.5	2.44	15.9
26	2.45	16.2	2.20	10.2	2.47	16.8	2.44	15.9
27	3.06	42.0	2.24	10.9	2.49	17.5	2.58	21.0
28	2.94	36.0	2.23	10.7	2.95	37.0	2.68	24.0
29	2.89	34.0	2.22	10.6	2.83	31.0	2.57	20.0
30	2.85	32.0	2.23	10.7	2.52	26.0	2.54	19.2
31	2.78	29.0	2.25	11.1	.....	.....	2.51	18.1

MONTHLY DISCHARGE of Swiftcurrent creek at Sinclair's ranch (Lower Station), for 1916

(Drainage area 366 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (24-31)	590	420.0	508.0	1.390	0.41	8 061
April	415	40.0	133.0	0.363	0.40	7,914
May	277	17.8	61.0	0.167	0.19	3,751
June	234	37.0	75.0	0.205	0.23	4,463
July	110	11.3	35.0	0.096	0.11	2,152
August	56	10.2	17.6	0.048	0.06	1,082
September	37	14.7	17.7	0.048	0.05	1,053
October	94	9.4	31.0	0.085	0.10	1,906
The period	.....	.....	.....	.....	1.55	30,382

MEAN MONTHLY DISCHARGE in Second-feet of Swiftcurrent creek at Sinclair's ranch (Lower Station)

MONTH	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	13.8	26.0	24.0	13.10	33.0	28.0	31	24.0	1,476
November	.....	.....	.....	34.0*d*	.....	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
March	.....	.....	.....	.....	.....	350.0*f*	508.0*h*	.....	.....	.....
April	.....	.....	.....	40.0*e*	102.00	83.0	133.0	.....	106.0	6,309
May	14.9*a*	38.0*b*	80.0*c*	31.0	22.00	52.0	61.0	.....	42.0	2,560
June	14.3	22.0	39.0	22.0	1.86	64.0	75.0	.....	34.0	2,169
July	7.2	17.0	16.9	11.7	2.90	44.0	35.0	.....	19.2	1,182
August	7.2	12.2	10.2	5.1	1.08	9.4	17.6	.....	9.0	551
September	12.7	30.0	15.1	8.0	14.10	15.7	17.7	.....	16.2	963
Total in Acre-feet	2,644	7,234	9,022	7,873	10,438	21,005	30,184	.....	.....	15,210

a 27-31.
b 12-31.
c 16-31.
d 1-15.
e 22-30.
f 28-31.
h 24-31.

SWIFTCURRENT CREEK NEAR SWIFT CURRENT (UPPER STATION)

Location.—On the SW. ¼ Sec. 12, Tp. 15, Rge. 14, W. 3rd Mer., above the water supply reservoir of the city of Swift Current.

Records available.—January 16, 1914, to December 31, 1916.

Gauge.—Vertical staff 50 feet up stream from bridge; zero elevation 91.95 feet; established April 7, 1916.

Bench-mark.—On upstream wing of left abutment; assumed elevation 105.00 feet. Marked "B. M. 105.00" with white paint.

Control.—Permanent

Discharge measurements.—At high stages from bridge; at low stages by wading or by weir.

Winter flow.—Affected by ice.

Observer.—Mrs. E. Mackintosh.

Remarks.—Open water discharge computed from hydrograph.

DISCHARGE MEASUREMENTS of Swiftcurrent creek near Swift Current (Upper Station), in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 8	W. R. McCaffrey	9.0	4.55	1.17	2.05*b*	5.30
Jan. 22	do	10.0	1.50	0.44	2.78	0.66
Feb. 4	H. W. Rowley	2.5	0.56	0.39	2.86	0.22
Feb. 18	do	48.0	11.50	0.51	3.70	5.90
Mar. 6	do	85.0	60.80	1.17	3.91*b*	71.00
Mar. 22	E. J. Switzer	95.0	369.00	2.86	9.89	1,058.00
April 6	do	70.0	206.00	1.32	3.42	281.00
May 5	do	67.0	132.00	0.71	2.81	94.00
June 9	do	47.7	72.20	1.53	3.02	111.00
July 5	do	72.8	259.00	1.48	4.45	383.00
July 31	do	48.0	69.00	1.22	3.03	84.00
July 31	do	51.5	79.60	1.18	3.03	90.00
Aug. 11	do	47.5	71.50	1.23	3.06	88.00
Oct. 13	F. R. Shenstone	44.5	48.60	1.20	2.82	58.00
Nov. 8	do	37.0	23.40	0.26	2.16*b*	6.20
Dec. 20	do	32.0	21.80	0.64	2.87*b*	14.00

b Ice conditions, Jan. 1 to Mar. 11 and from Nov. 8 to Dec. 31.

DAILY GAUGE HEIGHT AND DISCHARGE of Swiftcurrent creek near Swift Current (Upper Station), for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.50*bx*	6.50	2.15	0.35	.....	60	8.33	760	2.87	118	3.42	178
2	1.20	6.30	2.00	0.20	.....	60	6.83	690	2.90	118	3.31	161
3	1.20	6.10	.....	0.20	.....	60	6.33	520	2.85	110	3.21	150
4	1.40	5.90	2.86	0.22	.....	60	.....	460	2.89	100	3.19	138
5	1.50	5.80	2.95	0.70	.....	63	.....	360	2.81	94	3.18	126
6	1.60	5.70	3.00	1.10	3.91	71	3.42	281	2.78	92	3.01	120
7	1.85	5.50	3.10	1.50	3.87	76	4.26	406	2.75	88	3.00	116
8	2.05	5.30	3.15	1.70	3.85	85	4.18	375	2.72	87	2.96	111
9	.....	5.60	3.18	2.10	3.81	94	4.00	340	2.71	86	3.02	111
10	.....	6.00	3.22	2.50	3.79	104	3.80	300	2.69	85	3.01	135
11	2.08	6.30	3.30	2.90	3.75*b*	200	4.00	340	2.66	85	3.16	163
12	2.10	6.40	3.35	3.30	13.64	2,300	3.90	312	2.65	85	3.36	195
13	2.15	6.30	3.40	3.60	.....	1,960	3.80	309	2.64	85	3.56	236
14	2.25	6.10	3.45	4.10	.....	1,740	3.75	305	2.62	86	3.51	250
15	.....	5.80	3.48	4.50	.....	1,520	3.71	300	2.62	89	3.42	190
16	.....	5.50	3.55	5.00	.....	1,320	3.67	285	2.67	91	3.36	151
17	3.00	4.90	4.00	5.40	.....	1,180	3.60	270	2.70	92	3.30	140
18	3.00	4.10	3.70	5.90	.....	1,100	3.55	256	2.73	96	3.23	129
19	2.95	3.10	3.95	10.00	.....	1,075	3.48	242	2.77	102	3.13	108
20	2.90	1.90	3.92	17.00	.....	1,066	3.35	230	2.82	112	3.01	85
21	.....	1.00	3.87	21.00	.....	1,062	3.27	202	2.79	108	2.92	68
22	2.78	0.66	3.80	24.00	9.89*x*	1,058	3.16	185	2.76	104	2.90	65
23	2.75	0.70	.....	26.00	10.13	1,070	3.11	165	2.71	101	2.92	69
24	2.71	0.70	.....	28.00	10.23	1,080	3.07	148	2.66	100	3.02	86
25	2.68	0.70	.....	32.00	10.23	1,090	3.01	138	2.70	99	2.97	76
26	2.60	0.70	.....	36.00	10.38	1,100	2.96	131	3.01	132	2.92	63
27	2.50	0.70	.....	45.00	10.53	1,107	2.91	128	3.21	170	2.90	62
28	2.43	0.60	.....	54.00	10.43	1,086	2.91	123	3.39	240	2.92	66
29	2.30	0.55	.....	59.00	10.23	1,040	2.88	122	3.57	270	3.02	90
30	.....	0.50	.....	.....	9.98	900	2.86	120	3.51	242	3.22	130
31	.....	0.45	.....	.....	9.43	820	.....	.....	3.46	198	.....	.....

b-b Ice conditions; discharge determined from winter hydrograph.
x-x Gauge heights taken from gauge above permanent control, 600 feet above present gauge.

DAILY GAUGE HEIGHT AND DISCHARGE of Swiftcurrent creek near Swift Current (Upper Station), for 1916—*Concluded*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.37	156	2.95	76	.....	42	2.61	47	2.45	22.0	2.70	9.2
2	3.70	218	2.80	64	.....	42	2.64	47	2.38	18.0	2.71	9.5
3	5.17	950	2.75	53	.....	42	2.67	48	2.33	12.0	2.72	9.4
4	5.30	960	2.60	42	.....*x*	42	2.71	49	2.28	9.0	2.74	9.3
5	4.45	383	2.62	40	2.62	42	2.75	50	2.25	8.0	2.76	9.0
6	4.12	346	.....*x*	46	2.62	42	2.83	55	2.21	7.0	2.76	8.4
7	3.92	335	.....	51	2.61	43	2.85	61	2.19	7.0	2.74	7.4
8	3.92	335	.....	60	2.60	45	2.88	68	2.16*b*	6.2	2.73	6.7
9	4.00	360	.....	58	2.60	47	2.88	69	2.16	6.0	2.73	5.6
10	5.12	932	.....	77	2.62	50	2.86	69	2.23	6.0	2.73	4.7
11	4.75	870	3.06	88	2.65	49	2.84	66	2.28	6.6	2.75	3.9
12	4.52	620	.....	87	2.63	47	2.82	61	2.43	7.3	2.76	3.7
13	4.35	370	.....	83	2.62	45	2.82	58	2.50	8.1	2.71	3.9
14	4.18	314	.....	81	2.62	45	2.81	58	2.58	8.8	2.68	4.4
15	4.10	290	.....	80	2.61	45	2.81	59	2.58	9.5	2.66	5.1
16	3.00	80	.....	78	2.61	45	2.78	60	2.60	10.0	2.68	6.1
17	2.91	65	.....	76	2.61	45	2.76	60	2.63	10.2	2.68	7.7
18	2.84	63	.....	72	2.60	45	2.74	58	2.65	10.3	.....	10.6
19	2.79	58	.....	70	2.60	44	2.72	53	2.67	10.2	.....	12.7
20	2.73	51	.....	68	2.59	44	2.71	46	2.68	10.0	2.87	14.0
21	2.69	45	.....	64	2.59	43	2.68	45	2.68	9.4	2.94	14.7
22	2.67	38	.....	60	2.58	42	2.66	42	2.68	8.5	2.96	14.8
23	2.65	28	.....	57	2.56	40	2.64	39	2.68	7.8	2.96	14.9
24	2.61	21	.....	54	2.55	39	2.63	38	2.68	7.7	2.98	14.7
25	2.65	22	.....	51	2.55	39	2.62	38	2.68	7.6	2.99	14.4
26	2.69	26	.....	50	2.54	40	2.62	38	2.68	7.4	2.94	14.0
27	2.71	32	.....	48	2.56	45	2.61	38	2.68	7.5	2.87	13.6
28	2.80	40	.....	46	2.60	47	2.61	39	2.68	7.8	2.87	13.1
29	2.85	52	.....	46	2.60	47	2.58	37	2.68	8.3	2.85	12.7
30	2.93	70	.....	45	2.60	47	2.54	35	2.70	8.7	2.83	12.4
31	3.03	87	.....	42	.....	.....	2.48	30	.....	.....	2.78*b*	12.0

b-b Ice conditions; discharge determined from winter hydrograph.
x Observer away, Aug. 6 to Sept. 4.

MONTHLY DISCHARGE of Swiftcurrent creek near Swift Current (Upper Station), for 1916

(Drainage area 975 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	6.5	0.45	3.8	0.004	0.00	234
February	59.0	0.20	13.7	0.014	0.02	788
March	2,300.0	6.00	826.0	0.847	0.98	50,789
April	760.0	120.00	293.0	0.301	0.34	17,435
May	270.0	85.00	118.0	0.121	0.14	7,256
June	250.0	62.00	126.0	0.129	0.14	7,498
July	960.0	21.00	265.0	0.272	0.31	16,294
August	88.0	40.00	62.0	0.064	0.07	3,812
September	50.0	39.00	44.0	0.045	0.05	2,618
October	69.0	30.00	50.0	0.051	0.06	3,074
November	22.0	6.00	9.1	0.009	0.01	542
December	14.9	3.70	9.8	0.010	0.01	603
The year	.....	.....	.....	.....	2.13	110,943

SWIFTCURRENT CREEK NEAR SWIFT CURRENT (LOWER STATION)

Location.—On the NW. ¼ Sec. 18, Tp. 15, Rge. 13, W. 3rd Mer., below the water supply dam of the city of Swift Current.

Records available.—May 5, 1913, to December 31, 1916.

Gauge.—Vertical staff; zero elevation of gauge has been maintained at 87.19 feet since establishment.

Bench-marks.—On rock; assumed elevation up to June 11, 1914, 100.00 feet. From June 12, 1914, to December 31 1915; another rock has been used having an elevation of 97.24 feet referred to the same datum. New bench-mark established May 8, 1916, on post; assumed elevation 100.00feet, situated on right bank 50 feet back from gauge, and one foot out from horse barn.

Channel.—Permanent.

Discharge measurements.—With current-meter by wading or from bridge.

Winter flow.—Affected by ice.

Artificial control.—The flow of the creek at this point is affected to some extent by the city water supply dam.

Relation of gauge height to discharge.—Affected during spring by growth of weeds.

Observer.—Stanley Tite.

DISCHARGE MEASUREMENTS of Swiftcurrent creek near Swift Current (Lower Station), in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 8	W. R. McCaffrey	17.0	5.9	0.95	0.82*b*	5.6
Jan. 22	do	14.0	4.9	0.53	0.76*b*	2.6
Feb. 4	H. W. Rowley	9.0	3.6	0.59	0.55*b*	2.1
Feb. 18	do	20.0	8.8	0.33	0.67*b*	2.9
Mar. 6	do	55.0	91.0	0.63	1.82*b*	58.0
April 7	E. J. Switzer	75.2	104.6	2.75	2.90	287.0
May 5	do	54.3	108.4	0.83	2.03	90.0
June 9	do	57.0	120.7	0.91	2.31	110.0
July 5	do	60.7	171.0	2.23	3.13	381.0
July 31	do	56.0	112.9	0.72	2.05	82.0
July 31	do				2.05	37 0*w*
Aug. 11	do	55.0	106.0	0.76	2.11	82.0
Oct. 13	F. R. Shenstone	39.0	62.4	0.94	2.01	58.0
Nov. 8	do	35.0	40.3	0.22	1.49*b*	8.9
Dec. 20	do	25.0	17.8	0.79	1.61*b*	14.0

b Ice conditions, Jan. 1 to Mar. 11 and Nov. 8 to Dec. 31.
w Discharge determined by using dam as a weir.

DAILY GAUGE HEIGHT AND DISCHARGE of Swiftcurrent creek near Swift Current (Lower Station), for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	0.90*b*	8.10	0.60	1.70	1.75	53	3.22	416	2.07	101	2.49	163
2	0.90	7.70	0.55	1.70	1.70	54	3.42	496	2.12	111	2.44	148
3	0.90	7.30	0.60	1.70	1.55	56	3.22	416	2.10	105	2.39	134
4	0.93	6.80	0.55	2.10	1.65	57	3.37	476	2.09	102	2.29	112
5	0.95	6.40	0.55	2.30	1.75	57	3.12	376	2.03	90	2.29	110
6	0.90	6.00	0.57	2.50	1.82	58	2.97	316	2.02	88	2.29	109
7	0.85	5.80	0.52	2.40	1.60	60	2.90	287*s*	1.99	82	2.19	91
8	0.82	5.60	0.52	2.50	1.45	65	2.77	244	1.97	79	2.29	108
9	.....	5.20	0.62	2.40	1.45	70	2.82	268	1.97	78	2.31	110*s*
10	0.90	4.80	.....	2.40	1.55	80	2.87	290	1.97	77	2.29	107
11	0.95	5.00	0.64	2.60	1.60*b*	100	2.97	334	1.96	75	2.34	117
12	0.90	5.10	0.64	2.70	7.72	2,216	2.92	320	1.93	70	2.39	128
13	0.90	5.20	0.69	2.70	7.22	2,016	2.87	304	1.92	68	2.59	180
14	0.90	6.00	0.69	2.60	5.72	1,416	2.87	310	2.03	83	2.79	246
15	0.90	6.00	0.69	2.60	5.72	1,416	2.82	294	2.03	82	2.59	180
16	0.85	5.30	0.65	2.60	4.72	1,016	2.72	260	2.04	83	2.39	128
17	0.80	3.90	0.75	2.60	3.72	616	2.69	252	2.04	82	2.29	107
18	0.70	3.00	0.67	2.90	3.62	576	2.67	249	2.04	82	2.19	89
19	0.70	2.40	0.70	3.30	3.42	496	2.59	223	2.09	89	2.14	80
20	0.70	2.30	0.75	4.20	3.52	536	2.57	220	2.06	84	2.09	73
21	0.90	2.30	0.80	5.80	3.62	576	2.42	175	2.04	80	2.09	73
22	0.76	2.60	0.80	8.00	3.72	616	2.37	162	1.99	71	2.09	73
23	0.70	2.40	3.05	13.00	4.72	1,016	2.37	164	1.99	70	2.14	80
24	.....	2.00	2.70	22.00	4.72	1,016	2.32	153	1.99	70	2.14	80
25	0.70	1.70	2.55	28.00	3.72	616	2.22	130	.....	95*e*	2.14	80
26	0.70	1.70	2.20	35.00	3.22	416	2.22	131	2.29	120	2.14	80
27	0.70	2.30	2.10	42.00	3.72	616	2.22	133	2.39	142	2.09	73
28	0.70	2.30	2.10	47.00	4.72	1,016	2.17	121	2.59	199	2.14	80
29	.....	2.30	2.00	50.00	4.22	816	2.12	111	2.79	266	2.19	89
30	.....	2.30	.....	.....	4.02	736	2.12	112	2.69	229	2.29	107
31	0.65	1.90	.....	.....	3.42	496	.....	.....	2.59	194	.....	.....

b-b Ice conditions; discharge determined from winter hydrograph.
e Discharge estimated.
s Shifting conditions from April 7 to June 9.

DAILY GAUGE HEIGHT AND DISCHARGE of Swiftcurrent creek near Swift Current (Lower Station), for 1916—*Concluded*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.48	150	2.09	73	1.69	29.0	1.74	33	1.89	47.0	1.69	11.2
2	2.48	150	1.99	59	1.59	22.0	1.79	37	1.84	42.0	1.69	11.5
3	3.58	560	1.89	47	1.49	16.7	1.84	42	1.84	42.0	1.69	11.8
4	3.58	560	1.84	42	1.94	53.0	1.89	47	1.84	42.0	1.69	12 0
5	3.13	380	1.89	47	1.72	31.0	1.89	47	1.79	37.0	1.66	12.0
6	3.03	340	1.91	50	1.69	29.0	1.94	53	1.79	37.0	1.69	11.3
7	3.03	340	1.85	43	1.24	18.3	1.94	53	1.79	37.0	1.69	10.6
8	3.93	700	1.79	37	1.44	14.4	1.94	53	1.49	8.9	1.64	10.3
9	4.38	880	1.89	47	1.59	22.0	1.92	51	1.84	8.3	1.59	9.7
10	2.78	243	1.89	47	1.79	37.0	1.91	50	1.84*b*	8.1	1.59	9.5
11	2.49	152	2.11	76	1.78	36.0	1.91	50	1.79	8.1	1.54	9.5
12	2.39	128	1.99	59	1.69	29.0	1.89	47	1.74	8.2	1.54	9.8
13	2.24	98	1.99	59	1.72	31.0	2.01	62	1.64	8.6	1.54	10.4
14	2.09	73	1.99	59	1.72	31.0	1.93	52	1.64	9.5	1.54	11.7
15	2.04	66	1.89	47	1.69	29.0	1.91	50	1.69	10.1	1.54	12.6
16	1.99	59	1.89	47	1.69	29.0	1.91	50	1.69	10.4	1.49	13.1
17	1.99	59	1.89	47	1.74	33.0	1.89	47	1.69	10.5	1.49	13.5
18	1.94	53	1.89	47	1.74	33.0	1 80	38	1.69	10.4	1.49	13.7
19	1.94	53	1.89	47	1.74	33.0	1.79	37	1.69	10.0	1.49	13.7
20	1.89	47	1.89	47	1.72	31.0	1.79	37	1.74	9.5	1.61	14.0
21	1.84	42	1.89	47	1.64	25.0	1.84	42	1.74	8.9	1.54	13.7
22	1.84	42	1.79	37	1.29	9.5	1.89	47	1.74	8.6	1.49	13.3
23	1.84	42	1.79	37	1.29	9.5	1.89	47	1.79	8.5	1.39	12.7
24	1.84	42	1.79	37	1.43	14.0	1.89	47	1.79	8.4	1.39	12.4
25	1.84	42	.....	42*e*	1.39	12.4	1.87	45	1.73	8.5	1.44	12.0
26	1.89	47	1.89	47	1.49	16.7	1.84	42	1.69	8.7	1.49	12.0
27	1.94	53	1.79	37	1.74	33 0	1.84	42	1.69	9.1	1.49	12.1
28	1.99	59	1.69	29	1.74	33.0	1.89	47	1.69	9.6	1.49	12.2
29	2.19	89	1.69	29	1.74	33 0	1.89	47	1.69	10 2	1.49	12.5
30	2.19	89	1.59	22	1.74	33.0	1.89	47	1.69	10.7	1.49	12.7
31	2.05	82	1.69	29	.....	.....	1.89	47	.....	.....	1.44*b*	13.2

b-b Ice conditions; discharge determined from winter hydrograph.
e Discharge estimated.

MONTHLY DISCHARGE of Swiftcurrent creek near Swift Current (Lower Station), for 1916

(Drainage area 1,000 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	8.1	1.70	4.2	0.004	0.00	258
February	50.0	1.70	10.4	0 010	0.01	598
March	2,216.0	53.00	611.0	0 611	0.70	37,569
April	496 0	111.00	258.0	0 258	0 29	15,352
May	266.0	68.00	105.0	0.105	0.12	6,456
June	246 0	73 00	111.0	0.111	0 12	6,605
July	880.0	42 00	185.0	0 185	0 21	11,375
August	76.0	22 00	46.0	0 046	0 05	2,828
September	53 0	9 50	27.0	0 027	0 03	1,607
October	62 0	33 00	46.0	0 046	0 05	2,828
November	47.0	8.10	16.5	0.016	0 02	982
December	14.0	9.50	12.0	0.012	0.01	738
The year	.....	.....	.....	.....	1.61	87,196

MEAN MONTHLY DISCHARGE in Second-feet of Swiftcurrent creek near Swift Current (Lower Station)

MONTH	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	14.5	32	43.0	18.80	35.0	31.0	46.0	31.0	1,933
November	.....	.....	.....	33.0	.....	21.0	22.0	16.5	25.0	1,370
December	.....	.....	.....	11.4	.....	10.8	11.5	12.0	11.4	702
January	.....	.....	.....	.....	1.77	5.2	4.2	.....	3.7	229
February	.....	.....	.....	.....	2.10	3.1	10.4	.....	5.2	295
March	.....	498.0*a*	.....	.....	102.00	118.0	611.0	.....	277.0	17,032
April	.....	427.0	255*b*	193.0*c*	228.00	231.0	258.0	.....	286.0	17,018
May	38.00	76.0	136	55.0	41.00	72.0	105.0	.....	75.0	4,597
June	21.00	40.0	91	45.0	29.00	73.0	111.0	.....	59.0	3,493
July	15.00	28.0	27	34.0	6.50	85.0	185.0	.....	54.0	3,340
August	8.65	16.7	24	10.5	0.73	26.0	46.0	.....	18.9	1,166
September	18.20	49.0	30	4.7	20.00	21.0	27.0	.....	24.0	1,440
Total in acre-ft.	6,110	43,944	25,737	22,835	27,101	42,405	86,570	.....	.....	52,615

a 27-31.
b 21-31.
c 9-30.

ANTELOPE LAKE DRAINAGE BASIN

General Description

Antelope lake is a small body of saline water, six miles long and from one to one and one-half miles wide, situated at an elevation of 2,300 feet above sea-level. It lies in a deep depression north of the main line of the Canadian Pacific Railway, in Township 15, Range 18, West of the 3rd Meridian, and drains an area of about 350 square miles.

The lake receives most of its supply from Bridge creek, which rises in the Cypress hills. The altitude of the source of this creek is 2,800 feet and it has an average fall of fifteen feet per mile.

The valley traversed by Bridge creek is narrow and quite shallow, rarely exceeding 100 feet in depth. The land lying along the creek bottom is very flat and liable to become inundated during periods of flood. The bench land is rolling prairie, cut up by innumerable coulees which drain the surrounding country into the main valley.

The mean annual rainfall amounts to about fourteen inches, most of which occurs during May, June and July.

The creek has only a small flow, and is dry along most of its course for several months during the year.

BRIDGE CREEK AT RAYMOND'S RANCH

Location.—On the SE. ¼ Sec. 33, Tp. 10, Rge. 22, W. 3rd Mer.

Records available.—April 8, 1911, to October 31, 1916.

Gauge.—Vertical staff; the elevation of the zero of the gauge has been maintained at 89.42 feet since establishment.

Bench-marks.—Permanent iron bench-mark 45 feet northwest of gauge; assumed elevation 100.00 feet.

Discharge measurements.—Made with current-meter at flood stages and with weir at ordinary stage.

Winter flow.—This station is not maintained during the winter.

Observer.—Mrs. C. Raymond.

DISCHARGE MEASUREMENTS of Bridge creek at Raymond's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 30	E. J. Switzer	9.0	6.60	0.54	1.39	3.60
May 3	do	.....	.....	.....	0.70	0.42*w*
May 10	do	.....	.....	.....	0.67	0.36*w*
June 8	do	4.3	3.14	0.74	0.79	2.30
June 15	do	.....	.....	.....	0.71	0.84*w*
July 10	do	.....	.....	.....	0.61	0.36*w*
July 12	do	.....	.....	.....	0.57	0.28*w*
Aug. 6	do	.....	.....	.....	0.62	0.31*w*

w Discharge determined by using an 18-inch weir.

DAILY GAUGE HEIGHT AND DISCHARGE of Bridge creek at Raymond's ranch, for 1916

Day	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	1.38	3.50	0.86	0.81	1.21	2.40
2	.....	.....	1.29	2.90	0.81	0.67	1.17	2.20
3	.....	.....	1.35	3.30	0.70	0.42	1.11	1.87
4	.....	.....	1.30	3.00	0.74	0.50	1.06	1.62
5	.....	.....	1.22	2.50	0.66	0.36	1.16	2.10
6	.....	.....	1.15	2.10	0.71	0.44	0.86	0.81
7	2.01*b*	2.0	1.10	1.82	0.76	0.54	0.81	0.67
8	2.31	5.0	1.20	2.40	0.66	0.36	0.79	0.62
9	3.51	8.0	1.28	2.90	0.61	0.30	0.76	0.54
10	4.36	9.0	1.35	3.30	0.67	0.38	0.86	0.81
11	4.51	10.0	1.40	3.70	0.61	0.30	0.95	1.13
12	3.01	7.0	1.50	4.40	0.64	0.34	0.90	0.95
13	2.31	5.0	1.25	2.70	0.59	0.28	0.80	0.64
14	2.06	4.0	1.30	3.00	0.60	0.29	0.81	0.67
15	2.31*b*	5.0	1.20	2.40	0.61	0.30	0.71	0.44
16	1.91	7.4	1.26	2.70	0.71	0.44	0.70	0.42
17	1.91	7.4	1.21	2.40	0.87	0.85	0.80	0.64
18	2.06	8.5	1.19	2.30	0.81	0.67	0.75	0.52
19	2.26	10.0	1.17	2.20	0.67	0.38	0.70	0.42
20	1.91	7.4	1.11	1.87	0.74	0.50	0.65	0.35
21	2.51	11.8	1.13	1.98	0.77	0.57	0.60	0.29
22	2.21	9.6	1.06	1.62	0.71	0.44	0.85	0.78
23	1.96	7.8	1.11	1.87	0.79	0.62	0.80	0.64
24	2.16	9.3	1.06	1.62	0.76	0.54	0.76	0.54
25	2.11	8.9	1.04	1.52	0.89	0.92	0.75	0.52
26	1.91	7.4	0.86	0.81	0.99	1.30	0.70	0.42
27	1.86	7.0	0.96	1.17	1.21	2.40	0.70	0.42
28	1.61	5.2	1.06	1.62	1.33	3.20	0.75	0.52
29	1.41	3.7	1.11	1.87	1.23	2.60	0.88	0.88
30	1.39	3.6	1.01	1.39	1.21	2.40	0.70	0.42
31	1.37	3.5	.....	.....	1.31	3.10	.....	.....

b-b Ice conditions; discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of Bridge creek at Raymond's ranch, for 1916—*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	0.69	0 41	0.56	0 26	0.66	0.36	0.86	0.81
2	0.71	0.44	0.54	0 25	0.64	0.34	0 86	0.81
3	0.74	0.50	0.51	0.23	0.66	0.36	0.91	0.99
4	0.71	0.44	0.56	0 26	0.71	0.44	0 91	0.99
5	0.66	0.36	0.66	0.36	0.76	0.54	0.96	1.17
6	0.66	0.36	0.62	0.31	0.71	0.44	0.96	1.17
7	0.69	0.41	0.61	0.30	0.66	0.36	0.91	0.99
8	0.66	0.36	0.57	0.27	0.66	0.36	0.89	0.92
9	0.64	0.34	1.06	1.62	0.71	0.44	0.86	0.81
10	0.61	0.30	0.86	0.81	0.71	0.44	0.81	0.67
11	0.56	0.26	0.76	0.54	0.66	0.36	0.81	0.67
12	0.57	0.27	0.71	0.44	0.69	0.41	0.79	0.62
13	0.50	0.23	0.71	0.44	0.71	0.44	0.76	0.54
14	0.50	0.23	0.66	0.36	0.76	0.54	0.81	0.67
15	0.48	0.22	0.66	0.36	0.71	0.44	0.81	0.67
16	0.50	0.23	0.61	0.30	0.76	0.54	0.81	0.67
17	0.55	0.25	0.69	0.41	0.76	0.54	0.86	0.81
18	0.65	0 35	0.86	0.81	0.74	0.50	0.81	0.67
19	0.60	0.29	0.91	0.99	0.71	0.44	0.77	0.57
20	0.58	0.27	0.81	0.67	0.66	0.36	0. 81	0.67
21	0.55	0 25	0.71	0.44	0.69	0.41	0.76	0.54
22	0.53	0 24	0.66	0 36	0.71	0.44	0.76	0.54
23	0.50	0.23	0 66	0.36	0.69	0.41	0.81	0.67
24	0.55	0.25	0 64	0.34	0.66	0.36	0.81	0.67
25	0.63	0.33	0.66	0.36	0.71	0.44	0.79	0.62
26	0.65	0.35	0 69	0.41	0.76	0.54	0.79	0.62
27	0.70	0.42	0 66	0.36	0.81	0.67	0.81	0.67
28	0.75	0.52	0 61	0.30	0.79	0.62	0.81	0.67
29	0.70	0.42	0.57	0.27	0.76	0.54	0 76	0.54
30	0.65	0.35	0.61	0.30	0.81	0.67	0.79	0.62
31	0.60	0.29	0.64	0.34	.....	.....	0.76	0.54

MONTHLY DISCHARGE of Bridge creek at Raymond's ranch, for 1916

(Drainage area 6 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
May (7-31)	11.80	2.00	6.90	1.150	1.07	342
April	4 40	0.81	2.40	0.400	0.45	143
May	3.20	0 28	0.88	0.147	0.17	54
June	2 40	0.29	0.84	0.140	0.16	50
July	0.52	0.22	0.33	0.055	0.06	20
August	1 62	0 23	0 45	0.075	0 09	28
September	0.67	0.34	0.46	0.077	0.09	27
October	1.17	0.54	0.73	0.122	0.14	45
The period	.....	.....	.....	.....	2.23	709

MEEN MONTHLY DISCHARGE in Second-feet of Bridge creek at Raymond's ranch

MONTH	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	0.42*b*	0.36	0.16	1.07	0.77	0.73	0.62	38
November	.....	.....	0.43*c*	.....	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	.....	.....	.....	.....
March	.....	.....	9.80*d*	10.60	3.20*e*	6.90*f*	.....	10.60	651
April	1.25*a*	3.50	3.10	1.53	4.80	2.40	.....	3.10	182
May	0.66	1.78	0.23	0.19	2.70	0.88	.....	1.07	66
June	0.37	0.85	0.08	0.14	1.87	0.84	.....	0.69	41
July	0.33	0.28	0.13	0.02	2.90	0.33	.....	0.66	41
August	0.25	0.28	0.06	0.04	0.18	0.45	.....	0.21	13
September	0.46	0.26	0.15	0.38	0.62	0.46	.....	0.39	23
Total in acre-ft.	126	437	316	798	973	711	.....	.....	1,055

a 29-30.
b 1-24.
c 1-15.
d 29-31.
e 14-31.
f 7-31.

DIMMOCK BROTHERS' SOUTH DITCH FROM SPRING CREEK (NEAR SKULL CREEK P.O.)

Location.—On the SE. ¼ Sec. 16, Tp. 11, Rge. 21, W. 3rd Mer., and is two hundred and fifty feet northwest of the intake of the ditch and four hundred feet southeast of the flume.
Records available.—Incomplete records from 1912 to 1916.
Gauge.—Vertical staff; zero elevation maintained at 96.53 feet since establishment.
Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.
Channel.—One channel at all stages, clay bottom.
Discharge measurements.—Made with current-meter or weir.
Observers.—Dimmock Brothers.
Remarks.—There was no flow at any time the engineer visited the ditch in 1916, and no records were furnished by the owners of the ditch. Very little, if any, water was diverted.

BRIDGE CREEK AT GULL LAKE

Location.—On the SW. ¼ Sec. 24, Tp. 13, Rge. 19, W. 3rd Mer., at the highway bridge near the Canadian Pacific Railway station.
Records available.—During open water flow March 29, 1911, to October 31, 1916.
Gauge.—Vertical staff; zero maintained at 95.63 feet since establishment.
Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.
Channel.—Fairly permanent, but may be affected by vegetation.
Discharge measurements.—With the current-meter from bridge, or by wading; or with weir.
Winter flow.—No winter observations have been taken.
Observer.—J. R. Gaskell.

DISCHARGE MEASUREMENTS of Bridge creek at Gull Lake, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 6	E. J. Switzer	25.0	31.80	1.07	2.21	34.00
May 5	do	11.5	8.07	0.48	1.09	3.90
June 8	do	24.0	27.95	0.62	2.18	17.40
July 3	do	32.0	53.58	0.84	3.11	45.00
July 31	do	20.6	20.58	0.44	1.98	9.20
Aug. 14	do	15.0	13.48	0.45	1.55	6.00
Sept. 29	do	.....	.....	.....	0.28	Nil
Nov. 5	do	.....	.....	.....	0.65	0.05*e*

e Discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of Bridge creek at Gull Lake, for 1916

DAY	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	3.01	42.0	1.10	6.1	2.10	17.9
2	.....	.....	2.85	36 0	1.12	6.0	2 32	23.0
3	.....	.....	2.68	31.0	1.11	5.3	2.38	24.0
4	.....	.....	2.55	27 0	1.10	4.7	2.41	25.0
5	.....	.....	2.41	23.0	1.09	3.9	2.44	25.0
6	2.03	14.1	2.21	34.0*s*	1,04	3.5	2.42	24.0
7	2.21	18.1	2.19	34.0	1.02	3.4	2 28	20 0
8	2.41	23.0	2.10	31.0	0 98	3.1	2.18	17.4*s*
9	2 64	30.0	2.02	29 0	0 96	2 9	2 11	15 8
10	2.91	38.0	1.97	27.0	0.94	2.8	2.44	24.0
11	3.33	53.0	1.89	25.0	0.94	2 8	2.63	30.0
12	3 51	59.0	1.80	23.0	0.93	2 7	2 64	30.0
13	3.34	53.0	1.76	22 0	0 92	2 6	2 60	29.0
14	3.11	45.0	1.74	21.0	0.90	2 4	2 56	27.0
15	3.03*b*	35.0	1.72	21.0	0.88	2.2	4.52	93.0
16	2 88	28.0	1.62	18.4	0.89	2 2	2.47	25 0
17	2.61	22.0	1.52	16.0	1.32	6.5	2.49	25.0
18	2 53	20.0	1.49	15.2	1.28	5.8	2 40	23.0
19	2 98*b*	30.0	1.54	16.4	1.23	5.2	2.35	22.0
20	3.08	44.0	1.49	15.2	1.20	4.7	2.30	20 0
21	3.60	62.0	1.45	14.3	1.13	4.0	2.26	19.3
22	3.76	67.0	1.43	13.9	1.04	3 0	2.21	18.1
23	3.41	55.0	1.35	12.1	0.99	2.6	2.16	16.9
24	3.21	49.0	1.27	10.4	0.96	2.3	2.12	16.0
25	3.31	52.0	1.21	9.4	1.35	5.8	2.09	15.4
26	3.52	59.0	1.15	8.2	1.78	12.6	2.04	14.3
27	3.76	67.0	1.13	7.8	1.90	14.8	1.98	13.0
28	3.58	61.0	1.10	7.1	1.84	13.3	.....	18.3*e*
29	3.48	58.0	1.18	7.9	1.76	11.5	.....	24.0*e*
30	3.32	52.0	1.13	6.9	1.72	10.6	.....	29.0*e*
31	3.18	48.0	.....	.....	1.65	9.2	.....	.....

b-b Ice conditions; discharge estimated.
s Shifting conditions, April 6 to June 8.
e Discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of Bridge creek at Gull Lake, for 1916.—*Concluded.*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	34.0*e*	1.84	10.30	0.79	0.44	Dry	Nil
2	.....	40.0*e*	1.74	8.70	0.77	0.37	"	"
3	3.11	45.0	1.62	7.00	0.75	0.30	"	"
4	3.19	46.0	1.52	5.60	0.77	0.37	"	"
5	2.79	34.0	1.42	4.50	0.73	0.24	0.63	0.03
6	2.91	38.0	1.37	4.00	0.71	0.17	0.71	0.17
7	2.75	33.0	1.33	3.60	0.68	0.10	0.83	0.60
8	2.71	32.0	1.23	2.80	0.69	0.12	0.97	1.20
9	3.07	44.0	1.76	9.10	0.68	0.10	1.01	1.39
10	2.95	40.0	1.98	13.00	0.67	0.09	0.94	1.07
11	2.95	40.0	1.95	12.40	0.63	0.03	0.87	0.76
12	2.89	38.0	1.79	9.50	0.59	Nil	0.83	0.60
13	2.83	36.0	1.65	7.40	0.52	"	0.79	0.44
14	2.75	33.0	1.55	6.00	0.47	"	0.75	0.30
15	2.76	34.0	1.42	4.50	0.41	"	0.74	0.27
16	2.67	31.0	1.35	3.80	0.37	"	0.73	0.24
17	2.49	25.0	1.26	3.00	0.32	"	0.70	0.14
18	2.36	22.0	1.16	2.30	0.29	"	0.69	0.12
19	2.16	16.9	1.09	1.82	0.28	"	0.77	0.37
20	2.48	25.0	1.01	1.39	0.28	"	0.83	0.60
21	2.46	25.0	0.95	1.11	0.27	"	0.83	0.60
22	2.32	21.0	0.93	1.02	0.23	"	0.81	0.52
23	2.18	17.4	0.93	1.02	Dry	"	0.77	0.37
24	2.24	18.9	0.91	0.93	"	"	0.75	0.30
25	2.12	16.0	0.89	0.85	"	"	0.71	0.17
26	2.30	20.0	0.88	0.81	"	"	0.67	0.09
27	2.50	26.0	0.88	0.81	"	"	0.63	0.03
28	2.54	27.0	0.87	0.76	"	"	0.60	Nil
29	2.45	24.0	0.83	0.60	0.28	"	0.57	"
30	2.22	18.4	0.82	0.56	Dry	"	0.59	"
31	1.98	13.0	0.80	0.48	.....	.....	0.55	"

e Discharge estimated.

MONTHLY DISCHARGE of Bridge creek at Gull Lake, for 1916

(Drainage area 213 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (6-31)	67.00	14.10	44.00	0.207	0.20	2,269
April	42.00	6.90	20.00	0.094	0.10	1,190
May	14.80	2.20	5.40	0.025	0.03	332
June	93.00	13.00	24.00	0.113	0.13	1,428
July	46.00	13.00	29.00	0.136	0.16	1,783
August	13.00	0.48	4.20	0.020	0.02	258
September	0.44	0.00	0.08	0.000	0.00	5
October	1.39	0.00	0.33	0.002	0.00	20
The period	.....	.....	.....	.....	0.64	7,285

LAKE OF THE NARROWS DRAINAGE BASIN

General Description

Lake of the Narrows is a small lake three miles long and one and one-half miles wide, in Township 13, Range 22, West of the 3rd Meridian. It has a drainage area of about 200 square miles.

The principal stream in the basin is Skull creek, which rises in the eastern slope of Cypress hills. It flows through a narrow valley for the greater part of its course, but as it nears the lake, the valley widens out into large meadows. The surrounding country is rolling prairie.

In very dry years, such as 1910 and 1914, Skull creek goes dry for a short time. The mean annual precipitation in the drainage basin is about thirteen inches.

SKULL CREEK AT DOYLE'S RANCH

Location.—On the SE. $\frac{1}{4}$ Sec. 32, Tp. 10, Rge. 22, W. 4th Mer., near Thos. Doyle's house.

Records available.—April 8, 1911, to October 31, 1916.

Gauge.—Vertical staff fastened to post at left bank of creek; zero elevation of gauge 92.08 feet.

Bench-mark.—On stump located about forty feet from gauge on right bank; assumed elevation 100.00 feet.

Channel.—Composed of gravel and stones.

Discharge measurements.—Made with current-meter by wading about fifty feet below the gauge.

Observer.—Thos. Doyle.

DISCHARGE MEASUREMENTS of Skull creek at Doyle's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec-ft.*
Mar. 30	E. J. Switzer	19.0	11.80	1.36	2.85	16.20
May 3	do	18.4	8.48	0.59	2.53	5.00
May 9	do	18.4	7.56	0.52	2.47	3.90
June 5	do	19.1	19.48	1.96	3.28	38.00
June 15	do	18.9	8.32	0.82	2.57	6.80
July 10	do	18.3	5.40	0.52	2.38	2.80
July 12	do	18.2	4.96	0.37	2.35	1.84
Aug. 6	do	4.8	1.75	0.97	2.34	1.69

DAILY GAUGE HEIGHT AND DISCHARGE of Skull creek at Doyle's ranch, for 1916

DAY	February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	.....	4.0	2.70	10.4	.....	4.8*e*	.....	6.6*e*
2	.....	.....	.....	4.0	2.60	7.2	2.53	5.3	2.48	4.2
3	.....	.....	.....	3.0	2.55	5.8	2.53	5.3	2.48	4.2
4	.....	.....	.....	3.0	2.45	3.5	2.56	6.1	2.48	4.2
5	.....	.....	2.50	3.0	2.45	3.5	2.55	5.8	3.30	38.0
6	.....	.....	2.50	3.0	2.48	4.2	2.54	5.6	2.87	17.1
7	.....	.....	3.00	15.0	2.45	3.5	2.54	5.6	.....	15.8*e*
8	.....	.....	3.00	25.0	2.55	5.8	.....	4.6*e*	2.82	14.9
9	.....	.....	3.00	50.0	2.65	9.8	2.46	3.7	2.57	6.4
10	.....	.....	3.50*b*	100.0	2.73	11.5	2.47	3.9	2.72	11.1
11	.....	.....	6.25	160.0	2.75	12.2	2.46	3.7	2.71	10.8
12	.....	.....	4.90	128.0	2.75	12.2	2.48	4.2	2.86	16.6
13	.....	.....	4.00	77.0	2.75	12.2	2.46	3.7	.....	12.6*e*
14	.....	.....	3.70	61.0	2.70	10.4	2.46	3.7	2.66	9.1
15	.....	.....	3.30	38.0	2.68	9.8	.....	4.6*e*	2.57	6.4
16	5.00*b*	30.0	3.00	23.0	2.67	9.4	2.53	5.3	2.54	5.6
17	5.00	30.0	2.80	14.1	2.67	9.4	2.53	5.3	.....	4.8*e*
18	.....	28.0	2.86	16.6	2.67	9.4	2.51	4.8	2.48	4.2
19	4.50	25.0	2.65	8.8	2.65	8.8	2.51	4.8	2.46	3.7
20	4.40	23.0	3.65	58.0	2.61	7.5	2.48	4.2	2.46	3.7
21	4.30	22.0	4.05	80.0	2.56	6.1	2.47	3.9	2.44	3.3
22	4.30	22.0	3.48	48.0	2.56	6.1	2.47	3.9	2.44	3.3
23	4.30	22.0	3.35	41.0	2.56	6.1	2.55	5.8	2.43	3.1
24	4.20	20.0	2.90	18.4	2.55	5.8	2.52	5.1	2.44	3.3
25	3.90	15.0	2.72	11.0	2.55	5.8	2.87	17.1	2.43	3.1
26	3.70	12.0	3.00	23.0	2.54	5.6	2.87	17.1	2.44	3.3
27	3.40	10.0	3.45	47.0	2.54	5.6	2.95	21.0	2.44	3.3
28	3.00	7.0	3.15	31.0	2.55	5.8	2.87	17.1	2.43	3.1
29	2.80	5.0	2.85	16.2	2.53	5.3	2.68	9.8	2.46	3.7
30	.....	.....	2.70	10.4	2.49	4.4	2.67	9.4	2.46	3.7
31	.....	.....	2.70	10.4	.....	.....	2.66	9.1	.....	.....

b-b Ice conditions, Feb. 16 to Mar. 10; discharge estimated.
e Discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of Skull creek at Doyle's ranch, for 1916—*Concluded*

Day	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.45	3.50	2.36	2.00	2.34	1.70	2.42	3.0
2	2.46	3.70	2.35	1.80	2.34	1.70	.....	3.4*e*
3	2.52	5.10	2.34	1.70	2.33	1.50	2.46	3.7
4	2.45	3.50	2.34	1.70	2.35	1.80	.....	3.7*e*
5	2.45	3.50	2.36	2.00	2.37	2.10	.....	3.7*e*
6	2.43	3.10	2.34	1.70	2.35	1.80	2.46	3.7
7	2.43	3.10	2.34	1.70	2.35	1.80	.....	3.7*e*
8	2.40	2.60	.....	3.50*e*	2.35	1.80	2.46	3.7
9	2.40	2.60	2.56	6.10	2.35	1.80	.....	3.8*e*
10	2.38	2.30	2.38	2.30	2.34	1.70	2.47	3.9
11	.....	2.00*e*	2.45	3.50	2.35	1.80	2.48	4.2
12	2.35	1.80	2.36	2.00	2.36	2.00	.....	4.2*e*
13	.....	1.80*e*	2.36	2.00	2.35	1.80	2.48	4.2
14	2.35	1.80	2.35	1.80	2.36	2.00	2.46	3.7
15	2.34	1.70	2.35	1.80	2.36	2.00	2.45	3.5
16	2.34	1.70	2.35	1.80	2.36	2.00	2.46	3.7
17	2.35	1.80	2.35	1.80	2.35	1.80	2.47	3.9
18	2.44	3.30	2.34	1.70	2.36	2.00	2.47	3.9
19	2.38	2.30	2.35	1.80	2.36	2.00	2.47	3.9
20	2.36	2.00	2.34	1.70	2.35	1.80	2.47	3.9
21	2.34	1.70	2.34	1.70	2.35	1.80	.....	4.2*e*
22	2.33	1.50	2.33	1.50	2.36	2.00	2.49	4.4
23	2.32	1.40	2.33	1.50	2.37	2.10	2.49	4.4
24	2.32	1.40	2.32	1.40	2.36	2.00	.....	4.2*e*
25	2.32	1.40	2.33	1.50	2.37	2.10	2.47	3.9
26	2.69	10.00	2.34	1.70	2.42	3.00	.....	3.9*e*
27	2.56	6.10	2.34	1.70	2.57	6.40	2.47	3.9
28	2.51	4.80	2.34	1.70	2.42	3.00	.....	4.3*e*
29	2.34	1.70	2.35	1.80	2.41	2.80	2.50	4.6
30	2.34	1.70	2.35	1.80	2.41	2.80	.....	4.5*e*
31	2.35	1.80	2.34	1.70	.....	.....	2.49	4.4

e Discharge estimated.

MONTHLY DISCHARGE of Skull creek at Doyle's ranch, for 1916

(Drainage area 20 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
February (16-29)	30.0	5.00	19.4	0.970	0.51	539
March	160.0	3.00	36.0	1.800	2.08	2,214
April	12.2	3.50	7.4	0.370	0.41	440
May	21.0	3.70	6.9	0.345	0.40	424
June	38.0	3.10	7.8	0.390	0.44	464
July	10.0	1.40	2.8	0.140	0.16	172
August	6.1	1.40	2.0	0.100	0.12	123
September	6.4	1.50	2.2	0.110	0.12	131
October	4.6	3.00	3.9	0.195	0.22	240
The period	.....	.....	.....	.....	4.46	4,747

MEAN MONTHLY DISCHARGE in Second-feet of Skull creek at Doyle's ranch

MONTH	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	2.80*b*	3.00	1.88	4.70	2.6	3.9	3.20	198
November	.....	.....	4.40*d*	.....	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	19.4*h*	.....	.....	.....
March	.....	.....	.....	5.91*e*	15.00*f*	36.0	.....	36.00	2,214
April	17.90*a*	9.20*c*	30.00	16.00	17.40	7.4	.....	17.70	1,059
May	5.30	10.20	3.50	4.60	5.10	6.9	.....	5.90	365
June	2.30	5.30	2.40	0.97	6.20	7.8	.....	4.20	248
July	1.89	1.40	1.40	0.14	4.90	2.8	.....	2.10	128
August	1.21	1.69	1.19	0.18	1.55	2.0	.....	1.30	80
September	3.20	1.71	1.31	1.50	1.57	2.2	.....	1.92	114
Total in acre-ft.	1,661	1,526	2,724	1,741	2,883	4,667	.....	.....	4,406

a 8-30.
b 1-24.
c 22-30.
d 1-15.
e 13-31.
f 19-31.
h 16-29.

MANN DITCH

Location.—On NW. ¼ Sec. 32, Tp. 10, Rge. 22, W. 4th Mer., about one mile from Skull Creek post office.

Records available.—July 1, 1913, to October 31, 1915. No water used previous to 1915.

Gauge.—Vertical staff; zero maintained at elevation 98.10 feet since establishment.

Bench-mark.—Wooden plug on right bank of ditch; assumed elevation 100.00 feet.

Discharge measurements.—Made with current-meter or weir.

Observer.—James Mann.

Remarks.—No flow at time hydrometric engineer was in locality, and it is believed that very little, if any, water was diverted during 1916.

GORDON, IRONSIDES AND FARES DITCH FROM SKULL CREEK

Location.—On NW. ¼ Sec. 7, Tp. 12, Rge. 22, W. 3rd Mer., about three miles southeast of Crane Lake station.

Records available.—One discharge measurement was obtained on June 12, 1915.

Gauge.—Vertical staff situated on the right bank of the ditch about 500 feet below the headgate; zero elevation maintained at 94.01 feet since establishment.

Bench-mark.—Permanent iron bench-mark; also used as initial point of soundings, on the left bank of the ditch and 5.5 feet below the gauge. Assumed elevation 100.00 feet.

Channel.—One channel, light sandy loam bed.

Discharge measurements.—Made with meter or weir.

Observer.—Gordon, Ironsides and Fares.

Remarks.—This station was visited on August 28, 1916. There was no flow on that date, and it is believed that very little, if any, water was diverted during 1916.

CRANE LAKE DRAINAGE BASIN

General Description

Crane lake is one of the largest of the lakes which receive their supply from the drainage of the northern slope of the Cypress hills. It is situated in Township 13, Range 23, West of the 3rd Meridian and covers an area of some twenty-five square miles.

The lake has no outlet, is shallow, and the water is saline in character. It is fed by Piapot creek, which rises in the Cypress hills, flows northeastward, and is joined by Bear creek, in Section 18, Township 12, Range 23, West of the 3rd Meridian, before it reaches the lake.

The country to the north of the lake is rolling and of little use for agriculture, being the eastern end of a range of sand hills which extend northwestward some forty miles. South of the lake the country is rolling prairie, which is bare of tree growth, except along the creeks, where there is a small growth of willow and shrub. Closer to the hills the country becomes more broken and the tree growth increases, making the ravines and coulees at the head of the creeks natural reservoirs, which regulate the spring run-off considerably.

There are a number of irrigation schemes in operation and proposed, in this basin, also one or two industrial schemes along the main line of the Canadian Pacific Railway.

The mean annual precipitation of the northern part of the basin is about twelve inches, but in the hills this is exceeded. During the winter season, from November to April, the streams are frozen over.

BEAR CREEK AT UNSWORTH'S RANCH

Location.—On the SE. ¼ Sec. 18, Tp. 11, Rge. 23, W. 3rd Mer., at bridge about four miles from Piapot.

Records available.—June 22, 1908, to October 31, 1916.

Gauge.—Vertical staff; zero elevation has been maintained at 85.95 since establishment.

Bench-mark.—A circle of nails on the top of the stringer at the left abutment on the downstream side of the bridge; assumed elevation 100.00 feet.

Discharge measurements.—Made from the bridge or by wading with a current-meter or with a weir at low stages.

Winter flow.—This station is not maintained during winter.

Observer.—Miss A. Unsworth.

DISCHARGE MEASUREMENTS of Bear creek at Unsworth's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 29	E. J. Switzer	14.0	49.80	1.06	4.26	53.00
May 2	do	12.3	27.15	0.71	2.55	19.10
May 11	do	11.8	21.47	0.68	2.14	14.80
June 3	do	12.5	38.35	0.95	3.51	37.00
June 16	do	13.5	38.92	0.93	3.49	36.00
July 8	do	11.7	22.18	0.63	1.99	14.00
July 13	do	11.1	16.09	0.48	1.64	7.70
Aug. 4	do	10.7	14.81	0.39	1.39	5.80
Nov. 4	do	12.6	34.47	0.35	2.76	12.10

DAILY GAUGE HEIGHT AND DISCHARGE of Bear creek at Unsworth's ranch, for 1916

DAY	February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec. ft.*
1	.....	.....	3.03	2.0	4.43	57.0	2.52	20.0	4.22	52.0
2	.....	.....	.....*x*	Nil	3.28	32.0	2.55	21.0	3.97	46.0
3	.....	.....	.....	"	2.03	13.4	2.52	20.0	3.54	37.0
4	.....	.....	.....	"	2.78	24.0	2.55	21.0	3.42	35.0
5	.....	.....	.....	"	2.83	25.0	2.55	21.0	3.32	33.0
6	.....	.....	.....	"	2.91	26.0	2.52	20.0	6.67	126.0
7	.....	.....	.....	"	2.58	21.0	2.41	18.5	4.32	54.0
8	.....	.....	.....*x*	10	2.62	22.0	2.39	18.3	4.02	47.0
9	.....	.....	5.58	60	2.97	27.0	2.26	16.4	3.67	40.0
10	.....	.....	6.78	130	3.47	36.0	2.26	16.4	4.12	50.0
11	.....	.....	10.73	302*e*	3.72	41.0	2.16	15.1	6.03	104.0
12	.....	.....	13.48	405	3.47	36.0	2.11	14.4	8.48	203.0
13	.....	.....	8.93	223	3.47	36.0	2.11	14.4	5.18	77.0
14	.....	.....	7.40	154	3.47	36.0	2.09	14.2	4.28	54.0
15	4.48	31*e*	5.88	99	3.47	36.0	2.11	14.4	3.81	43.0
16	10.08	200	5.43	84	3.21	31.0	2.26	16.4	3.48	36.0
17	11.28	230	4.23	52	2.91	26.0	2.56	21.0	3.23	31.0
18	12.63	250	4.03	48	3.41	35.0	2.49	19.7	3.08	29.0
19	10.43	205	3.45	35	3.26	32.0	2.26	16.4	2.88	26.0
20	9.78	190	4.93	70	3.11	29.0	2.16	15.1	2.75	24.0
21	9.23	175	8.32	195	2.86	25.0	2.07	13.9	2.43	18.8
22	8.23	160	8.23	191	2.81	24.0	2.10	14.3	3.32	33.0
23	7.88	145	6.13	107	2.73	23.0	2.22	15.9	4.08	49.0
24	6.67	105	4.98	71	2.56	21.0	2.82	25.0	3.03	28.0
25	5.98	72	3.73	41	2.49	19.7	3.52	37.0	3.08	29.0
26	4.13	26	3.48	36	2.45	19.1	4.72	64.0	2.68	22.0
27	4.23	28	5.88	99	2.44	19.0	6.47	119.0	2.58	21.0
28	4.43	30	5.55	88	2.42	18.7	6.65	126.0	2.45	19.1
29	3.68	13	4.28	54	2.42	18.7	6.77	130.0	3.68	40.0
30	.....	.....	4.43	57	2.44	19.0	5.12	75.0	3.53	37.0
31	.....	.....	4.47	58	.....	.....	4.92	70.0	.....	.....

e-e Discharge estimated.
x-x Creek frozen solid; no gauge readings.

DAILY GAUGE HEIGHT AND DISCHARGE of Bear creek at Unsworth's ranch, for 1916 —*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.34	33.0	1.57	7.5	1.22	3.3	2.56	16.8
2	3.17	30.0	1.50	6.7	1.27	3.9	2.56	16.6
3	2.67	22.0	1.37	5.1	1.32	4.5	2.69	18.2
4	2.82	25.0	1.34	4.8	1.47	6.3	2.91	21.0
5	2.37	18.0	1.32	4.5	1.67	8.7	2.90	21.0
6	2.20	15.6	1.32	4.5	1.62	8.1	2.87	20.0
7	2.07	13.9	1.32	4.5	1.54	7.2	2.89	20.6
8	1.97	12.6	1.34	4.8	1.47	6.3	2.90	19.9
9	1.97	12.6	2.03	13.4	1.50	6.7	2.89	19.5
10	1.97	12.6	2.87	25.0	1.52	6.9	2.89	19.1
11	1.82	10.7	2.07	13.9	1.47	6.3	2.90	19.1
12	1.77	10.0	1.92	12.0	1.47	6.3	2.91	19.0
13	1.64	8.4	1.82	10.7	1.47	6.3	2.93	18.9
14	1.60	7.9	1.70	9.1	1.57	7.5	2.95	18.7
15	1.57	7.5	1.57	7.5	1.67	8.7	2.96	18.8
16	1.50	6.7	1.40	5.5	1.72	9.4	2.93	18.1
17	1.44	6.0	1.37	5.1	1.79	10.0s	2.91	17.6
18	1.42	5.7	1.67	8.7	1.86	10.6	2.89	17.2
19	2.54	20.0	1.92	12.0	1.93	11.3	2.87	16.6
20	3.17	30.0	1.67	8.7	1.93	11.0	2.83	15.8
21	2.72	23.0	1.42	5.7	2.01	12.5	2.81	15.2
22	2.20	15.6	1.36	5.0	2.11	13.0	2.81	15.0
23	1.50	6.7	1.32	4.5	2.19	13.8	2.77	14.3
24	1.44	6.0	1.27	3.9	2.37	16.0	2.77	13.9
25	1.42	5.7	1.30	4.3	2.39	16.1	2.77	13.6
26	2.54	20.0	1.32	4.5	2.43	16.5	2.79	13.8
27	3.17	30.0	1.34	4.8	2.51	17.2	2.81	13.8
28	2.72	23.0	1.32	4.5	2.91	23.0	3.06	16.9
29	2.20	15.6	1.30	4.3	2.79	21.0	2.98	15.5
30	2.02	13.3	1.24	3.6	2.56	17.3	2.91	14.5
31	1.84	10.9	1.17	2.8	.....	.....	2.89	13.8s

s-s Shifting conditions.

MONTHLY DISCHARGE of Bear creek at Unsworth's ranch, for 1916

(Drainage area 100 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
February (15-29)	250	13.0	124.0	1.240	0.69	3,688
March	405	Nil	86.0	0.860	0.99	5,288
April	57	13.4	28.0	0.280	0.31	1,666
May	130	13.9	34.0	0.340	0.39	2,091
June	203	18.8	48.0	0.480	0.54	2,856
July	33	5.7	16.4	0.154	0.18	947
August	25	2.8	7.2	0.072	0.08	443
September	23	3.3	10.5	0.105	0.12	625
October	21	13.6	17.2	0.172	0.20	1,058
The period	.....	.....	.....	.....	3.50	18,662

MEAN MONTHLY DISCHARGE in Second-feet of Bear creek at Unsworth's ranch

MONTH	1907–8	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	14.3	10.30	6.5	9.1	8.00	3.40	6.9	9.7	17.2	9.5	583
November	.....	.....	.....	.....	8.2*g*	8.70*d*	.....	.....	.....	.....		
December	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	.....	.....	.....	124.0*h*	.....	.....	.....
March	.....	.....	.....	.....	.....	.....	36.00*e*	18.9*f*	86.0	.....	86.0	5,288
April	.....	77.0*b*	16.60	48.0*c*	170.0	126.00	34.00	50.0	28.0	.....	71.0	4,203
May	.....	55.0	8.50	38.0	39.0	13.70	10.00	15.7	34.0	.....	27.0	1,641
June	6.3*a*	85.0	4.80	11.2	22.0	5.40	4.20	16.0	48.0	.....	25.0	1,461
July	5.3	41.0	1.50	8.4	5.5	4.00	0.22	9.5	15.4	.....	10.1	620
August	6.7	6.1	1.05	3.3	4.5	0.99	Nil	2.4	7.2	.....	3.6	220
September	5.2	5.1	3.70	10.0	4.2	0.52	0.72	5.0	10.5	.....	5.0	297
Total in acre-ft.	1,158	13,728	2,800	5,658	15,480	9,717	4,574	6,797	18,200	.....	.....	14,313

a 22-30.
b 23-30.
c 21-30.
d 1-15.
e 12-31.
f 20-31.
g 1-15.
h 15-29.

NEEDHAM BROTHERS' DITCH FROM BEAR CREEK

Location.—On the SW. ¼ Sec. 30, Tp. 11, Rge. 23, W. 3rd Mer., about two miles south of Piapot.

Records available.—Discharge measurements only from 1911 to 1914, and complete records during the irrigation season of 1915 and 1916.

Gauge.—Vertical staff; zero elevation maintained at 88.63 feet since establishment.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—One channel at all stages.

Discharge measurements.—Made with a weir or current-meter.

Observer.—Robert Needham.

Remarks.—Water was diverted from July 7 to July 14 only, in 1916.

DISCHARGE MEASUREMENTS of Needham Brothers' ditch from Bear creek, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
July 8	E. J. Switzer	11.2	11.78	0.60	1.79	7.0
July 13	do	7.7	5.95	0.42	1.34	2.5
Aug. 29	do	.....	.....	.....	.....	Nil

DAILY GAUGE HEIGHT AND DISCHARGE of Needham Brothers' ditch from Bear creek, for 1916

JULY			JULY		
Day	Gauge Height	Discharge	Day	Gauge Height	Discharge
7	1.11	1.24	11	1.90	8.80
8	1.79	7.10	12	1.90	8.80
9	1.90	8.80	13	1.34	2.50
10	1.90	8.80	14	1.85	8.00

Total discharge for period, 108 acre-feet.

BRANIFF DITCH FROM BEAR CREEK

Location.—On the SE. ¼ Sec. 30, Tp. 11, Rge. 23, W. 3rd Mer.
Records available.—One discharge measurement in 1914.
Gauge.—Vertical staff at headgate; elevation of zero 95.91 feet.
Bench-mark.—On post, three inches in diameter, with spike driven in top; assumed elevation 100.00 feet.
Discharge measurements.—Made with current-meter by wading.
Observer.—D. Braniff.
Remarks.—Water used for five or six hours on June 4, 1916. Flow about 1 second-foot.

MCCARTHY, BERTRAM AND SALT WEST DITCH FROM BEAR CREEK

Location.—On NW. ¼ Sec. 29, Tp. 11, Rge. 23, W. 3rd Mer., about 300 feet down stream from the dam.
Records available.—Discharge measurements only in 1914. Records for irrigation season of 1915.
Gauge.—Vertical staff; zero elevation maintained at 96.84 feet since establishment.
Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.
Channel.—Clay with a growth of vegetation.
Discharge measurements.—Made with current-meter or weir.
Observer.—W. Salt.
Remarks.—This station visited on August 29, 1916, but there was no flow, but it is understood that a small quantity of water was diverted during the spring.

MCCARTHY, BERTRAM AND SALT EAST DITCH FROM BEAR CREEK

Location.—On the NW. ¼ Sec. 29, Tp. 11, Rge. 23, W. 3rd Mer., near Piapot and 300 feet northeast of dam, and 75 feet below headgate.
Records available.—For irrigation season of 1915, gauge heights only in 1916.
Gauge.—Vertical staff; zero elevation 95.10 feet.
Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.
Channel.—Clay, with heavy growth of vegetation.
Discharge measurements.—Made with current-meter or weir.
Observer.—D. Bertram.
Remarks.—Gauge heights of water during 1916 as follows:—July 4, 2.40 feet; July 5, 3.90 feet; July 6, 3.70 feet; July 8, 3.40 feet. Estimated flow about 4 or 5 second-feet. Water used only from July 4 to July 8.

TRANTER SOUTH DITCH FROM PIAPOT CREEK

Location.—On the NW. ¼ Sec. 5, Tp. 10, Rge. 24, W. 3rd Mer.
Gauge.—Vertical staff located 450 feet below headgate on the left bank of the ditch; zero elevation maintained at 97.22 feet since establishment.
Bench-mark.—A wooden plug surrounded by stones on right bank of ditch, 4 feet up stream from gauge; assumed elevation 100.00 feet.
Channel.—One at all stages; gravel bed.
Discharge measurements.—Made with current-meter or weir.
Observer.—G. Tranter.
Remarks.—This station was established on May 20, 1915, but no records were obtained in 1915. No discharge measurements in 1916. Gauge heights, reported as follows:—May 22 to May 26, five days, 1.40 feet each day. It is believed that very little water was used during 1916.

TRANTER NORTH DITCH FROM PIAPOT CREEK

Location.—On NE. ¼ Sec. 7, Tp. 10, Rge. 24, W. 3rd Mer.
Gauge.—Vertical staff located 800 feet below the headgate on left bank of ditch; zero elevation maintained at 98.88 feet since establishment.
Bench-mark.—A six-inch log surrounded by stones on right side of ditch and 5 feet up stream from gauge; assumed elevation 100.00 feet.
Channel.—One at all stages; bed clean.
Discharge measurements.—Made with current-meter or weir.
Observer.—C. Tranter.
Remarks.—This station was established on May 20, 1915, but no records were obtained in 1915. No records were received for 1916, and it is believed that no water was used.

MOORHEAD DITCH FROM PIAPOT CREEK

Location.—On SE. ¼ Sec. 25, Tp. 10, Rge. 25, W. 3rd Mer., near the centre of the quarter-section and about 400 feet from the intake of the ditch.

Records available.—Discharge measurements only in 1912 to 1914, records for irrigation season of 1915, and partial records for 1916.

Gauge.—Vertical staff; zero elevation maintained at 95.42 feet.

Bench-mark.—On a three-inch post, used as I.P., driven into ground about one foot from gauge and surrounded by small stones; assumed elevation 100.00 feet.

Channel.—One permanent channel. Bed consists of small rocks of about two inches in diameter.

Discharge measurements.—Made with current-meter or weir.

Observer.—H. Moorhead.

Remarks.—No discharge measurements were obtained in 1916. The following gauge heights were reported:—June 8, 1.40 feet; June 14, 1.20 feet; June 21, 1.10 feet; June 28, 1.10 feet; July 5, 1.10 feet; July 12, 1.10 feet; July 15, water turned off. Estimated average flow, 3.0 second-feet.

FEARON DITCH FROM PIAPOT CREEK

Location.—On SW. ¼ Sec. 6, Tp. 11, Rge. 24, W. 3rd Mer., about 1,000 feet from the intake of ditch.

Records available.—Discharge measurements taken during the irrigation seasons of 1914 and 1915.

Gauge.—Vertical staff; zero maintained at elevation of 97.41 feet since establishment.

Bench-mark.—Top of post used as final point of measurements; assumed elevation 100.00 feet.

Channel.—Clay, covered with grass.

Discharge measurements.—Made with current-meter or weir.

Observer.—Fd. Fearon.

Remarks.—No records were received for 1916, and it is believed that no water was diverted.

BEVERIDGE WEST DITCH FROM PIAPOT CREEK

Location.—On the NW. ¼ Sec. 18, Tp. 10, Rge. 24, W. 3rd Mer., about 350 feet below point of intake.

Records available.—Irrigation seasons, June 5, 1911, to October 31, 1916.

Gauge.—Vertical staff; zero elevation maintained at 97.82 feet during 1915 and 1916.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—Clay and gravel, permanent.

Control.—A permanent control has been placed on this ditch below the gauge.

Discharge measurements.—Made with current-meter or weir.

Observer.—D. Peveridge.

Remarks.—Water was used for five days only during 1916. The gauge heights were:—May 30, 0.78 foot; May 31, 0.78 foot; June 2, 0.68 foot; June 3, 0.68 foot; July 6, 0.85 foot. Average discharge about 0.75 second-foot.

CUMBERLAHD DITCH FROM PIAPOT CREEK

Location.—On SW. ¼ Sec. 17, Tp. 11, Rge. 24, W. 3rd Mer., about 300 feet from the headgate of the ditch.

Records available.—Partial records from June 27, 1914, to date.

Gauge.—Vertical staff; zero maintained at 98.00 feet since establishment.

Bench-mark.—Wooden stake used for I.P.; assumed elevation 100.00 feet.

Channel.—Clay, fairly permanent.

Discharge measurements.—Made with meter and weir.

Observer.—Andrew Cumberland.

Remarks.—This station was visited once or twice during 1916, but there was no flow, and it is understood that no water was used during 1916.

PIAPOT CREEK AT CUMBERLAND'S RANCH

Location.—On the NE. ¼ Sec. 18, Tp. 11, Rge. 24, W. 3rd Mer.

Records available.—July 4, 1908, to October 31, 1916; from July 4, 1908, to May 12, 1909, the records were taken three-quarters mile up stream from the present gauge.

Gauge.—Vertical staff; zero elevation maintained at 89.75 feet during 1909-11, and at 88.75 feet during 1912-16.

Bench-marks.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Discharge measurements.—Made with a weir at low stages and with current-meter at ordinary stages.

Winter flow.—This station is not maintained during the winter.

Artificial control.—A log buried in the bed of the stream about fifteen feet below the gauge forms a control at this station.

Diversions.—Messrs. Fearon and Moorhead, D. Beveridge, Geo. Tranter and A. Cumberland divert water for irrigation purposes above this station.

Observer.—A. Cumberland.

DISCHARGE MEASUREMENTS of Piapot creek at Cumberland's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Fee.*	*Sec.-ft.*
Mar. 29	E. J. Switzer	12.5	11.60	1.06	1.91	12.3
April 29	do	12 5	9.93	1.23	1.73	12.2
May 12	do	11.4	6 28	0.76	1.38	4.8
June 2	do	13.3	20.12	1.28	2.39	26.0
June 16	do	12.9	19.68	1.05	2.13	21.0
July 7	do	12 9	13.22	0.57	1.63	7.5
July 13	do	13.2	4.36	0.54	1.40	2.4
Aug. 3	do	12.1	8.48	0.44	1.41	3.7
Aug. 28	do	12.8	4.28	0.72	1.42	3.1

DAILY GAUGE HEIGHT AND DISCHARGE of Piapot creek at Cumberland's ranch, for 1916

Day	February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1				12.0	1.83	10.8	1.69	8.0	2.48	31.0
2				13.0	1.73	8.6	1.68	7.8	2.39	28.0
3				13.0	1.72	8.5	1.65	7.2	2.21	22.0
4				14.0	1.76	9.6	1.66	7.4	2.09	16.2
5				14.0	1.68	8.0	1.59	6.0	2.64	36.0
6				15.0	1.71	8.8		5.5*e*	3.85	77.0
7				15.0	1.57	6.0	1.54	5.1	2.75	40.0
8				20.0	1.64	7.5	1.49	4.3	2 23	22.0
9			5.71	20.0	1.73	9.6	1.40	3.0	2.10	18.5
10				21.0	1.75	10.2	1.39	2.9	2 96	47.0
11			6.06	22.0*g*	1.80	11.5		2.8*e*	4.23	90.0
12			6.16	25.0*g*	1.87	13.4	1.38	2.8	4..2	86.0
13			5.15	15.0*g*	1.91	14.7	1.40	3.0	2.93	46.0
14			4.70	10.0*g*	1.90	14.5		3.2*e*	2 42	29.0
15				10.0*g*	1.88	14.1	1.43	3.4	2.21	22.0
16				15.0*g*	1.89	14.6		5.1*e*	2.13	19.4
17				20.0*g*	1.75	11.1	1.63	6.8	2.10	18.5
18				30.0*g*	2.02	18.7	1.52	4.8	1.89	13.2
19			*b*	50.0*g*	1.99	17.9	1.44	3.6	1.77	9.7
20			3.75	74.0	1.84	13.9	1.39	2.9	1.58	5.8
21			3.70	72.0	1.78	12.4	1.52	4.8	1.57	5.7
22	5.51*b*	18.0	2 82	42.0	1.72	11.1	1.47	4.0	1.93	13.7
23	5.20	16.0	2 24	23.0	1.64	9.4	1.65	7.2	2.66	37.0
24	5.15	15.0	2.03	16.4	1.62	9.1	1.93	13.7		26.0*e*
25	5.15	15.0	1.98	15.0	1.62	9.1	3.00	48.0	1.96	14.5
26	4.89	12.0	1.92	13.4	1.57	8.2	3.21	56.0	1.62	6.6
27		10.0	1.98	15.0	1.54	7.7	3.84	77.0	1.92	13.4
28		10.0	2.00	15.6	1.58	8.8*s*	3.38	61.0	1.89	13.0
29		10.0	1.91	12 3*d*	1.73	12.2*d*	3.97	82.0	1.88	12.4
30			1.64	6.5*s*	1.66	7.4	3.31	59.0	2.93	46.0
31				8.7*e*			2.77	41.0		

b-b Ice conditions; discharge estimated.
e Discharge estimated.
g Ice going out.
d Actual measurement.
s-s Shifting conditions.

DAILY GAUGE HEIGHT AND DISCHARGE of Piapot creek at Cumberland's ranch, for 1916.—*Concluded.*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.07	17.6	1.55	5.3	1.39	2.90	.....	3.4*e*
2	1.78	10.0	1.48	4.2	1.38	2.80	1.43	3.4
3	2.20	22.0	1.41	3.1	1.37	2 60	1.52	4.8
4	2.38	27.0	1.38	2.8	1.42	3.30	1.54	5.1
5	1.86	11.9	1.41	3.1	1.58	5.80	1.51	4.7
6	1.69	8.0	.....	3.0*e*	1.50	4.50	1.66	7.4
7	1.63	6.8	1.38	2 8	1.46	3.90	1.73	8.9
8	1.59	6.0	1.36	2.5	1.41	3.10	1.60	6.2
9	1.63	6.8	2.76	40.0	1.39	2.90	1.56	5.5
10	.....	5.7*e*	2.90	45.0	1.42	3.30	1.54	5.1
11	1.50	4.5	2.70	38.0	1.41	3.10	1.54	5.1
12	1.46	3.9	1.90	12.9	1.33	2.20	1.62	6.6
13	1.40	3.0	1.73	8.9	1.35	2.40	1.64	7.0
14	1.38	2.8	1.63	6.8	1.37	2.60	1.76	9.5
15	1.35	2.4	1.54	5.1	1.38	2.80	1.72	8.6
16	1.32	2.0	1.39	2.9	1.34	2.30	1.62	6.6
17	1.63	6.8	1.48	4.2	.....	2.00*e*	1.54	5.1
18	.....	9.6*e*	2.40	28.0	1.30	1.80	1.55	5.3
19	1.88	12.4	1.80	10.4	1.35	2.40	1.52	4.8
20	1.63	6.8	1.62	6.6	1.29	1.68	1.52	4.8
21	1.49	4.3	1.54	5.1	1.32	2.00	1.51	4.7
22	1.43	3.4	1.51	4.7	1.32	2.00	1.50	4.5
23	1.35	2.4	1.46	3.9	1.29	1.68	1.49	4.3
24	1.36	2 5	1.52	4.8	.....	1 84*e*	1.48	4.2
25	1.36	2.5	1.39	2.9	1.32	2.00	1.47	4.0
26	1.43	3.4	1.46	3.9	1.32	2.00	1.48	4.2
27	6.78	177.0	1.46	3.9	1.46	3.90	1.66	7.4
28	2.33	26.0	1.42	3.3	.....	4.00*e*	.....	6.7*e*
29	1.89	13.0	1.41	3.1	1.48	4.20	1.59	6.0
30	1.66	7.4	.....	3.0*e*	1.43	3.40	.....	5.4*e*
31	1.62	6.6	.....	3.0*e*	.....	.....	1.51	4.7

e Discharge estimated.

MONTHLY DISCHARGE of Piapot creek at Cumberland's ranch, for 1916

(Drainage area 55 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
February (22-29)	18.0	10.00	13.2	0.240	0.07	209
March	74.0	6.50	22.0	0.400	0.46	1,353
April	18.7	6.00	10.9	0.198	0.22	649
May	82.0	2.80	17.7	0.322	0.37	1,088
June	90.0	5.70	29.0	0.527	0.59	1,726
July	177.0	2.00	13.7	0.249	0.29	842
August	45.0	2.50	8.9	0.162	0.19	547
September	5.8	1.68	2.8	0.051	0.06	167
October	9.5	3.40	5.6	0.102	0.12	344
The period	.....	.....	.....	.....	2.37	6,925

MEAN MONTHLY DISCHARGE in Second-feet of Piapot creek at Cumberland's ranch

MONTH	1908-9	1909-10	1910-11	1911-12	1912-13	1913-14	1914-15	1915-16	1916-17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	2.70	0.90	3.8	2.60	0.71	2.8	3.6	5.6	2.8	173
November	.....	.....	.....	.....	2.30*e*	.....	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	.....	.....	13.2*f*	.....	.....	.....
March	.....	.....	.....	.....	.....	12.60*c*	9.5*d*	22.0	.....	22.0	1,353
April	.....	4.20	9.90*a*	36.0*b*	53.00	6.30	6.5	10.9	.....	16.2	963
May	16.5	1.04	5.70	16.0	6.40	1.54	2.3	17.7	.....	8.4	517
June	39 0	0.78	3.40	10.1	1.79	0.51	9.3	29.0	.....	11.7	700
July	17.0	0.64	4.50	3.9	0.69	0 07	11.6	13.7	.....	6.5	400
August	3.5	0.77	1 96	3.7	0 43	0 04	2.2	8.9	.....	2.7	166
Sept	2.7	0.96	5.40	2.2	0.44	0.73	2.8	2.8	.....	2.3	134
Total in Acre-ft.	4,776	672	1,820	4,335	3,978	1,120	2,591	6.802	.....	.....	4,406

a 5-30.
b 4-30.
c 12-31.
d 15-31.
e 1-15.
f 22-29.

MISCELLANEOUS DISCHARGE MEASUREMENTS made in Crane lake drainage basin, in 1916

Date	Engineer	Stream	Location	Width	Area of Section	Mean Velocity	Discharge
				Feet	*Sq. ft.*	*Ft. per sec.*	*Sec.-ft.*
May 10	E. J. Switzer	East br. Bear creek	NE. 29-10-23-3	12.3	7.23	0.68	4.90
June 16	do	do	do	13.2	11.30	0.86	9.80
July 8	do	do	do	11.9	5.92	0.59	3.50
July 13	do	do	do	11.4	5.14	0.35	1.79
Aug. 4	do	do	do	5.5	1.83	0.61	1.12
May 10	do	West br. Bear creek	NW. 29-10-23-3	12.7	7.68	1.12	8.60
June 16	do	do	do	16.6	13.90	1.92	27.00
July 8	do	do	do	14.1	9.69	1.06	10.20
July 13	do	do	do	13.2	7.07	0.65	4.60
Aug. 4	do	do	do	9.6	6.14	0.63	3.90
April 29	do	Piapot creek	SE. 25-10-25-3	12.8	8.78	0.90	7.90
May 12	do	do	do	12.7	6.60	0.49	3.30
June 2	do	do	SE. 36-10-25-3	14.1	12.40	1.46	18.10
July 7	do	do	do	12 0	6.13	0.34	2.10
Aug. 3	do	do	do	7.4	1.44	0.56	0 83
July 13	do	Spring coulee	SE. 8-11-23-3	4.0	1.40	0.49	0 69
Aug. 4	do	do	do	.....	.....	.....	0.71*w*

w Discharge determined by using an 18-inch weir.

HAY LAKE DRAINAGE BASIN

General Description

Hay lake is in Township 11, Range 25, West of the 3rd Meridian, and is fed by Hay creek, which rises in the Cypress hills. It is a comparatively sn all body of saline water of an approximate area of three square miles. Like most lakes in this locality it has no outlet.

The basin supplies water for a few small irrigation schemes, and also to the town of Maple Creek for domestic and industrial purposes, the water being piped some nine miles by means of a gravity system.

The annual precipitation averages about twelve inches.

HAMMOND WEST DITCH FROM EAST BRANCH OF HAY CREEK

Location.—On SW. $\frac{1}{4}$ Sec. 16, Tp. 10, Rge. 25, W. 3rd Mer., 12 feet from the dam.
Records available.—For irrigation season of 1915.
Gauge.—Vertical staff, three feet long; zero maintained at elevation 93.963 feet during 1915.

Bench-mark.—A three-quarter-inch iron bar on a gravel knoll 250 feet east of the weir in the west ditch, and midway between the east and west ditches. Protected by rocks. Assumed elevation 100.00 feet.

Channel.—One channel, heavy black loam, highly gravelled.

Discharge measurements.—Made directly from the ditch weir.

Observer.—G. R. Hammond.

Remarks.—This station was visited on August 26, 1916, but there was no flow, and it is believed that very little, if any, water was diverted during 1916.

HAMMOND EAST DITCH FROM EAST BRANCH OF HAY CREEK

Location.—On SW. ¼ Sec. 16, Tp. 10, Rge. 25, W. 3rd Mer., about 200 feet from intake of ditch.

Records available.—For irrigation season of 1915.

Gauge.—Vertical staff, three feet long; zero maintained at elevation 97.81 feet during 1915.

Bench-mark.—A three-quarter-inch iron bar on a gravel knoll midway between the east and west ditches and 250 feet west of the station; assumed elevation 100.00 feet.

Channel.—One channel with a gravelly clay bed.

Discharge measurements.—Made with current-meter or weir.

Observer.—G. R. Hammond.

Remarks.—This station was visited on August 26, 1916, but there was no flow and it is believed that very little, if any, water was diverted during 1916.

HAY CREEK AT HAY CREEK SCHOOL

Location.—On the SW. ¼ Sec. 29, Tp. 10, Rge. 25, W. 3rd Mer.

Records available.—March 24, 1911, to October 31, 1916.

Gauge.—Vertical staff; zero elevation has been maintained at 94.79 feet since establishment.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—Slightly shifting.

Discharge measurements.—Made with weir at ordinary stages and with a current-meter in high water periods.

Winter flow.—This station is not maintained during the winter.

Diversions.—The town of Maple Creek takes its water from springs at the head of this creek.

Observer.—Miss M. E. Fauquier.

DISCHARGE MEASUREMENTS of Hay creek at Hay Creek school, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 29	E. J. Switzer	9.0	4.35	1.06	1.60	4.70
April 27	do	8.0	2.45	0.46	1.37	1.13
May 13	do	.....	.....	.....	1.38	0.84*w*
June 2	do	10.6	7.10	1.27	1.82	9.00
June 17	do	10.5	5.96	0.75	1.60	4.50
July 7	do	9.8	4.17	0.33	1.39	1.38
July 14	do	.....	.....	.....	1.26	0.30*w*
Aug. 3	do	.....	.....	.....	1.19	0.18*w*
Aug. 26	do	.....	.....	.....	1.23	0.20*w*
Sept. 28	do	5.9	1.22	0.42	1.24	0.51
Nov. 3	do	6.3	1.64	0.62	1.32	1.02

w Discharge determined by using an 18-inch weir.

DAILY GAUGE HEIGHT AND DISCHARGE of Hay creek at Hay Creek school, for 1916

DAY	February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			1.50	2.0	1.52	3.20	1.42	1.74	1.86	9.90
2			1.50	2.0	1.54	3.50	1.40	1.50	1.82	9.00
3			1.60	3.0	1.51	3.10	1.40	1.50	1.71	6.70
4			1.60	3.0	1.36	1.08	1.40	1.50	1.66	5.70
5			1.60	3.0	1.37	1.18	1.40	1.50	1.96	12.10
6			1.61	3.0	1.52	3.20	1.57	4.10	2.25	18.50
7			1.61	3.0	1.52	3.20	1.52	3.20	1.85	9.70
8			1.71	5.0	1.52	3.20	1.52	3.20	1.65	5.50
9			2.03*b*	10.0	1.62	5.00	1.52	3.20	1.60	4.60
10			2.33	20.0	1.68	6.10	1.52	3.20	1.95	11.90
11			2.42	22.0	1.68	6.10	1.50	2.90	2 95	34.00
12			2.22	17.8	1.70	6.50	1.45	2.10	2.25	18.50
13			2.12	15.6	1.55	3.70	1.38	1.29	2.20	17.40
14			1.76	7.7	1.55	3.70	1.40	1.50	1.90	10.80
15			1.76	7.7	1.60	4.60	1.45	2.10	1.85	9.70
16			1.63	5.1	1.70	6.50	1.42	1.74	1.70	6.50
17			1.57	4.1	1.60	4.60	1.42	1.74	1.60	4.60
18			1.60	4.6	1.55	3.70	1.41	1.62	1.60	4.60
19			1.72	6.9	1.55	3.70	1.39	1.39	1.50	2.90
20			2.06	14.3	1.55	3.70	1.37	1.18	1.46	2.30
21			2.46	23.0	1.49	2.70	1.35	0.97	1.46	2.30
22			2.21	17.6	1.47	2.40	1.38	1.29	1.65	5.50
23			1.91	11.0	1.42	1.74	1.53	3.40	2.10	1.52
24			1.92	11.2	1.52	3.20	1.83	9.30	1.75	7.50
25			1.77	7.9	1.40	1.50	1.88	10.40	1.65	5.50
26			1.62	5.0	1.40	1.50	2.25	18.50	1.55	3.70
27	1.11*b*	0.50	1.93	11.5	1.37	1.18	2.32	20.00	1.55	3.70
28	1.39	1.40	1.76	7.7	1.36	1.08	.....	24.00*e*	1.55	3.70
29	1.49	2.00	1.60	4.6	1.34	0.89	2.64	27.00	1.50	2.90
30			1.49	2.7	1.33	0.81	1.65	5.50	1.50	2.90
31			1.50	2.9	.....	.....	1.91	11.00	.....	.....

b–b Ice conditions; discharge estimated.
e Discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of Hay creek at Hay Creek school, for 1916—*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.61	4.80	1.26	0.35	1.10	0.07	1.18	0.15
2	1.56	3.90	1.21	0.20	1.10	0.07	1.18	0.15
3	1.73	7.10	1.19	0.16	1.10	0.07	1.23	0.25
4	1.53	3.40	1.16	0.12	1.14	0.10	1.31	0.64
5	1.43	1.86	1.16	0.12	1.10	0.07	1.31	0.64
6	1.39	1.39	1.21	0.20	1.10	0.07	1.31	0.64
7	1.39	1.39	1.21	0.20	1.10	0.07	1.32	0.72
8	1.36	1.08	1.11	0.08	1.05	0.04	1.33	0.81
9	1.36	1.08	1.76	7.70	1.08	0.06	1.30	0.56
10	1.35	0.97	1.51	3.10	1.10	0.07	1.28	0.46
11	1.32	0.72	1.31	0.64	1.08	0.06	1.27	0.40
12	1.35	0.97	1.22	0.22	1.08	0.06	1.27	0.40
13	1.26	0.35	1.19	0.16	1.09	0.06	1.27	0.40
14	1.26	0.35	1.16	0.12	1.12	0.09	1.27	0.40
15	1.12	0.09	1.04	0.04	1.12	0.09	1.26	0.35
16	1.33	0.81	1.15	0.11	1.12	0.09	1.25	0.30
17	1.27	0.40	1.42	1.74	1.12	0.09	1.24	0.27
18	1.12	0.09	1.31	0.64	1.08	0.06	1.24	0.27
19	1.15	0.11	.....	0.46*e*	1.08	0.06	1.24	0.27
20	1.15	0.11	1.25	0.30	1.07	0.05	1.24	0.27
21	1.15	0.11	1.16	0.12	1.07	0.05	1.24	0.27
22	1.15	0.11	1.16	0.12	1.07	0.05	1.24	0.27
23	1.18	0.15	1.16	0.12	1.07	0.05	1.24	0.27
24	1.18	0.15	1.16	0.12	1.07	0.05	1.23	0.25
25	1.18	0.15	1.15	0.11	1.13	0.09	1.23	0.25
26	1.88	10.40	1.23	0.25	1.14	0.10	1.23	0.25
27	1.91	11.00	1.18	0.15	1.17	0.13	1.32	0.72
28	1.61	4.80	1.10	0.07	1.24	0.27	1.32	0.72
29	1.46	2.30	1.10	0.07	1.17	0.13	1.26	0.35
30	1.39	1.39	1.10	0.07	1.17	0.13	1.24	0.27
31	1.29	0.51	1.10	0.07	.....	.....	1.22	0.22

e Discharge estimated.

MONTHLY DISCHARGE of Hay creek at Hay Creek school, for 1916

(Drainage area 22 square miles)

MONTH	DISCHARGE IN SECOND-FEET.				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
February (27-29)	2.00	0.50	1.30	0.059	0.01	8
March	23.00	2.00	8.50	0.386	0.44	523
April	6.50	0.81	3.20	0.145	0.16	190
May	27.00	0.97	5.60	0.255	0.29	344
June	34.00	2.30	8.60	0.391	0.44	512
July	11.00	0.09	2.00	0.091	0.10	123
August	7.70	0.04	0.58	0.026	0.03	36
September	0.27	0.04	0.08	0.004	0.00	5
October	0.81	0.15	0.39	0.018	0.02	24
The period	.....	.....	.....	.....	1.49	1,765

MEAN MONTHLY DISCHARGE in Second-feet of Hay creek at Hay Creek school

MONTH	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	0.61	0.21	Nil	2.20	0.10	0.39	0.58	36
November	.....	0.80*d*	0.22*f*	.....	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	1.30*m*	.....	.....	.....
March	4.80*a*	.....	.....	3.20*h*	3.70*k*	8.50	.....	8.50	523
April	6.10	2.90*e*	7.60	3.10	2.90	3.20	.....	4.60	273
May	1.11	6.90	0.31	1.66	1.11	5.60	.....	2.80	170
June	0.38	1.48	0.08	0.08	0.51	8.60	.....	1.86	110
July	1.15*b*	.....	0.04	Nil	1.18	2.00	.....	0.80	50
August	0.04*c*	0.23	0.01	"	0.15	0.58	.....	0.19	12
September	0.61	0.16	Nil	"	0.18	0.08	.....	0.17	10
Total in acre-ft.	593	662	508	369	579	1,747	.....	.....	1,184

a 24-31.
b 1-8.
c 14-31.
d 1-3.
e 16-30.
f 1-15.
h 20-31.
k 21-31.
m 27-29.

FAUQUIER DITCH FROM HAY CREEK

Location.—On SW. ¼ Sec. 29, Tp. 10, Rge. 25, W. 3rd Mer., about twenty feet down stream from the headgate.

Records available.—For irrigation season of 1915 and 1916.

Gauge.—Vertical staff; zero elevation maintained at 92.80 feet since March 29, 1915.

Bench-mark.—Permanent iron bench-mark located 300 feet east of the gauge and across Hay creek; assumed elevation 100.00 feet.

Channel.—One channel at all stages.

Discharge measurements.—Made with a weir.

Observer.—Miss M. Fauquier.

Remarks.—Ditch was used during 1916 from April 12 to April 30.

DISCHARGE MEASUREMENTS of Fauquier's ditch from Hay creek, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 27	E. J. Switzer	.....	.....	.....	1.30	0.22*w*
April 27	do	.....	.....	.....	1.36	0.39*w*
April 27	do	.....	.....	.....	1.26	0.12*w*
Aug. 26	do	.....	.....	.....	Dry	Nil

w Weir measurement.

DAILY GAUGE HEIGHT AND DISCHARGE of Fauquier's ditch from Hay creek, for 1916

APRIL			APRIL			APRIL			APRIL		
Day	Gauge Height	Discharge	Day	Gauge Height	Discharge	Day	Gauge Height	Discharge	Day	Gauge Height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*
.....	.....	.....	16	1.55	1.20	21	1.36	0.39	26	1.35	0.36
12	1.80	2.60	17	1.50	0.95	22	1.33	0.30	27	1.35	0.36
13	1.63	1.66	18	1.45	0.73	23	1.26	0.12	28	1.34	0.33
14	1.45	0.73	19	1.40	0.53	24	1.35	0.36	29	1.32	0.28
15	1.55	1.20	20	1.40	0.53	25	1.35	0.36	30	1.31	0.25

Total discharge for the period equals 26 acre-feet.

PEACOCK WEST DITCH FROM HAY CREEK

Location.—On SW. ¼ Sec. 35, Tp. 10, Rge. 26, W. 3rd Mer., about five miles southeast of Maple Creek, Saskatchewan.

Gauge.—Vertical staff situated on right bank of ditch about 55 feet below the headgate; zero elevation maintained at 98.50 feet since establishment.

Bench-mark.—On a wooden plug, used as initial point for soundings, situated on the right side of ditch, about four feet below the gauge; assumed elevation 100.00 feet.

Channel.—One channel with clay loam bed.

Discharge measurements.—Made with current-meter or weir.

Observer.—F. W. Peacock.

Remarks.—This station was established on May 19, 1915. No records were obtained in 1915 or 1916, but it is believed that some water was diverted by flooding directly from the creek above the intake to the ditches.

PEACOCK EAST DITCH FROM HAY CREEK

Location.—On SW. ¼ Sec. 36, Tp. 10, Rge. 26, W. 3rd Mer., five miles southeast of Maple Creek, Saskatchewan.

Gauge.—Vertical staff situated on the right bank of the ditch, about 100 feet below the intake; zero elevation maintained at 98.63 feet since establishment.

Bench-mark.—On a wooden plug used as the initial point for soundings on the right bank of ditch about five feet below the gauge; assumed elevation 100.00 feet.

Channel.—One channel with clay loam bed.

Discharge measurements.—Made by current-meter or weir.

Observer.—F. W. Peacock.

Remarks.—This station was established on May 19, 1915. No records were obtained in 1915 or 1916, but it is believed that some water was diverted by flooding directly from the creek above the intake to the ditches.

BIGSTICK LAKE DRAINAGE BASIN

General Description

Pigstick is one of the largest lakes in the northern Cypress Hills district. It is situated about Township 15, Range 25, West of the 3rd Meridian, and covers an area of 35 square miles. The lake is alkaline in character and has no outlet.

The only source of supply of the lake is Maple creek, which, with its tributary, Gap creek, rises in the Cypress hills, thirty-five miles south. On the south and east the lake is bounded by the Sand hills. The drainage area is 820 square miles.

The topography of the drainage basin is for the most part gently rolling and the creek slope is small except near the source. The basin is bare of trees except in the hills. The channel is flat, wide, and in most places sandy.

There are several small irrigation ditches in the basin.

ADAMS NORTH DITCH NEAR CYPRESS P.O.

Location.—On the NE. ¼ Sec. 10, Tp. 9, Rge. 27, W. 3rd Mer., at Geo. A. Adam's ranch.

Records available.—For irrigation seasons of 1914-1915.

Gauge.—Vertical staff, located near the left bank and 50 feet below the headgate; elevation of zero 97.14 feet.

Bench-marks.—Top of wooden stake, about eight feet from gauge on the left bank; assumed elevation 100.00 feet.

Control.—A permanent 24-inch, sharp-crested weir, with complete end contractions, acts as a control. The crest of the weir is maintained at an elevation of 99.09 feet.

Channel.—Composed of a black sandy loam.

Discharge measurements.—Computed from the measured head over the 24-inch weir.

Observer.—Geo. A. Adams.

Remarks.—This station was visited May 16 and August 24, 1916, and no flow reported. It is understood, however, that a little water was used.

ADAMS SOUTH DITCH NEAR CYPRESS P.O.

Location.—On the NW. ¼ Sec. 10, Tp. 9, Rge. 27, W. 3rd Mer., at Geo. A. Adams' ranch.

Records available.—For the irrigation seasons of 1914-15-16.

Gauge.—Vertical staff located near the left bank about 100 feet below the headgate; elevation of zero 91.8 feet.

Bench-mark.—Permanent iron bench-mark located on the quarter-section line 200 feet south of the gauge and weir; assumed elevation 100.00 feet.

Control.—A permanent 24-inch, sharp-crested weir, with complete end contractions, is used as a control. The elevation of the crest was maintained at 93.18 feet during 1916.

Channel.—Composed of sandy loam.

Discharge measurements.—Computed from the measured head over the weir.

Observer.—Geo. A. Adams.

Remarks.—Ditch was used from April 4 to May 24, in 1916.

DISCHARGE MEASUREMENTS of Adams' South ditch near Cypress P.O., in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 26	E. J. Switzer				1.78	0.42*w*
May 16	do				1.77	0.38*w*
Aug. 24	do				Dry	Nil

w Discharge determined by measured head of water over a 24-inch weir.

DAILY GAUGE HEIGHT AND DISCHARGE of Adams' South ditch near Cypress P.O., for 1916

April			April			May			May		
Day	Gauge Height	Discharge	Day	Gauge Height	Discharge	Day	Gauge Height	Discharge	Day	Gauge Height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*
.....	.....	.....	16	1.85	0.72	1	1.79	0.46	16	1.77	0.38
.....	.....	.....	17	1.86	0.76	2	1.78	0.42	17	1.78	0.42
.....	.....	.....	18	1.85	0.72	3	1.80	0.50	18	1.77	0.38
4	1.75	0.31	19	1.76	0.34	4	1.82	0.58	19	1.77	0.38
5	1.75	0.31	20	1.78	0.42	5	1.81	0.54	20	1.77	0.38
6	1.74	0.27	21	1.80	0.50	6	1.81	0.54	21	1.76	0.34
7	1.75	0.31	22	1.79	0.46	7	1.79	0.46	22	1.75	0.31
8	1.78	0.42	23	1.76	0.34	8	1.78	0.42	23	1.81	0.54
9	1.87	0.81	24	1.78	0.42	9	1.78	0.42	24	1.80	0.50
10	1.90	0.96	25	1.79	0.46	10	1.78	0.42	.....	.....	.....
11	1.85	0.72	26	1.79	0.46	11	1.76	0.34	.....	.....	.....
12	1.85	0.72	27	1.79	0.46	12	1.76	0.34	.....	.....	.....
13	1.90	0.96	28	1.80	0.50	13	1.77	0.38	.....	.....	.....
14	1.85	0.72	29	1.80	0.50	14	1.77	0.38	.....	.....	.....
15	1.85	0.72	30	1.80	0.50	15	1.77	0.38	.....	.....	.....

MONTHLY DISCHARGE of Adams' South ditch near Cypress P.O., for 1916

MONTH	DISCHARGE IN SECOND-FEET			Total Discharge in Acre-feet
	Maximum	Minimum	Mean	
April (4-30)	0.96	0.27	0.55	29
May (1-24)	0.58	0.31	0.42	20
The period				49

GEORGE POLLOCK'S WEST DITCH FROM CYPRESS CREEK

Location.—On the SW. ¼ Sec. 17, Tp. 9, Rge. 27, W. 3rd Mer., about seven hundred feet below headgates.

Records available.—For the years 1914-16.

Gauge.—Vertical staff fastened to post driven into the bed of the ditch near the left bank; elevation of zero 96.61 feet.

Bench-mark.—On post; assumed elevation 100.00 feet.

Channel.—Composed of gravel.

Discharge measureemnts.—Made by measuring head over permanent weir.

Control.—A permanent sharp crested rectangular weir, ten feet below gauge rod, with thirty-six-inch crest, maintained at 97.25 feet.

Observer.—George Pollock.

Remarks.—Water used only from April 18 to May 31, in 1916, as shown by records below.

DISCHARGE MEASUREMENTS of Geo. Pollock's West ditch from Cypress creek, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 26	E. J. Switzer				0.87	1.09*w*
May 16	do				0.84	0.88*w*

w Discharge determined by using a 36-inch permanent weir.

DAILY GAUGE HEIGHT AND DISCHARGE of Geo. Pollock's West ditch from Cypress creek, for 1916

APRIL			MAY			MAY			MAY		
DAY	Gauge Height	Discharge	DAY	Gauge Height	Discharge	DAY	Gauge Height	Discharge	DAY	Gauge Height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*
18	0.94	1.61	1	0.92	1.45	14	0.86	1.01	27	0.85	0.95
19	0.95	1.69	2	0.89	1.23	15	0.85	0.95	28	0.85	0.95
20	0.93	1.53	3	0.87	1.09	16	0.84	0.88	29	0.86	1.01
21	0.91	1.38	4	0.87	1.09	17	0.84	0.88	30	0.85	0.95
22	0.91*a*	1.38	5	0.87	1.09	18	0.82	0.76	31	0.86	1.01
23	0.91	1.38	6	0.88	1.15	19	0.83	0.82			
24	0.91	1.38	7	0.88	1.15	20	0.80	0.63			
25	0.90	1.30	8	0.87	1.09	21	0.80	0.63			
26	0.87	1.09	9	0.85	0.95	22	0.91*a*	0.68			
27	0.89	1.23	10	0.82	0.76	23	0.82*a*	0.76			
28	0.96	1.77	11	0.85	0.95	24	0.83*a*	0.82			
29	0.96	1.77	12	0.85	0.95	25	0.84*a*	0.88			
30	0.95	1.69	13	0.85	0.95	26	0.85	0.95			

Discharge computed from head over 36-inch permanent weir.
Gauge height 0.64 is point of zero flow.
a Gauge height interpolated.

MONTHLY DISCHARGE of Geo. Pollock's West ditch from Cypress creek, for 1916

MONTH	DISCHARGE IN SECOND-FEET			Total Discharge in Acre-ft.
	Maximum	Minimum	Mean	
April (1-18)	1.77	1.09	1.48	38
May	1.45	0.63	0.95	58
The period				96

GEORGE POLLOCK'S EAST DITCH FROM CYPRESS CREEK

Location.—On the SW. ¼ Sec. 17, Tp. 9, Rge. 27, W. 3rd. Mer., about fifty feet below headgate of ditch.

Gauge.—Vertical staff fastened to post driven into bed of ditch; zero maintained at 0.85 feet below crest of permanent weir.

Channel.—Composed of gumbo.

Discharge measurements.—Made by measuring head over permanent weir located ten feet below gauge.

Control.—Permanent sharp crested rectangular weir with thirty-six-inch crest.

Observer.—George Pollock.

Remarks.—This station was established May 19, 1914. No water was used during 1915. This station was visited on August 24, 1916, but there was no flow and it is believed that no water was diverted during 1916.

GAP CREEK AT SMALL'S RANCH

Location.—On the SE. ¼ Sec. 4, Tp. 10, Rge. 27, W. 3rd Mer., at Wm. Small's ranch.

Records available.—April 24, 1909, to October 31, 1916.

Gauge.—Vertical staff. The zero of the gauge was maintained at 66.53 feet during 1909-10; the zero of the gauge was maintained at 66.62 feet during 1911; the zero of the gauge was maintained at 66.63 feet during 1912-15; the zero of the gauge was maintained at 87.35 feet during 1916.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—Composed of loose stones and gravel and liable to shift during flood stages.

Discharge measurements.—Made from cable car during high stages and by wading or with a weir during low stages.

Winter flow.—Station discontinued during winter season.

Observer.—A. Small.

DISCHARGE MEASUREMENTS of Gap creek at Small's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 22	P. A. Fetterley	36.0	44.40	1.44	1.32	77.00
Mar. 28	E. J. Switzer	25.0	25.80	2.55	1.31	66.00
April 25	do	27.0	20.41	0.20	0.73	4.00
May 15	do	18.8	12.52	0.19	0.69	2.40
June 1	do	45.5	39.82	1.60	1.34	71.00
July 6	do	27.5	17.11	0.83	0.95	14.90
July 28	do	22.0	12.65	0.54	0.81	8.30
Aug. 23	do	13.5	6.10	0.14	0.61	0.86
Sept. 27	do	5.3	0.92	0.34	0.57	0.31

DAILY GAUGE HEIGHT AND DISCHARGE of Gap creek at Small's ranch, for 1916

DAY	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	1.01	20.0	0.77	5.70	1.34	72.0
2	.....	.....	0.98	17.4	0.80	7.00	1.23	50.0
3	.....	.....	0.95	14.9	0.79	6.60	1.12	32.0
4	.....	.....	0.90	12.0	0.77	5.70	1.04	23.0
5	.....	.....	0.88	11.0	0.78	6.10	1.35	74.0
6	.....	.....	0.88	11.0	0.76	5.20	2.25	271.0
7	.....	.....	0.85	9.4	0.76	5.20	1.42	88.0
8	1.46*b*	97.0	0.85	9.4	0.72	3.80	1.14	35.0
9	1.52	110.0	1.00	19.1	0.70	3.20	1.04	23.0
10	1.72	154.0	1.13	34.0	0.72	3.80	1.15	37.0
11	2.53	333.0	1.12	32.0	0.69	2.90	3.21	482.0
12	1.98	212.0	1.10	30.0	0.69	2.90	2.20	260.0
13	1.41	86.0	1.04	23.0	0.69	2.90	1.39	82.0
14	1.28	59.0	1.05	24.0	0.68	2.70	1.21	46.0
15	1.18*b*	41.0	1.08	27.0	0.69	2.90	1.14	35.0
16	1.13	34.0	1.01	20.0	0.70	3.20	1.05	24.0
17	1.11	31.0	0.88	11.0	0.74	4.50	0.99	18.3
18	1.08	27.0	0.85	9.4	0.72	3.80	0.94	14.3
19	0.98	17.4	0.87	10.4	0.69	2.90	0.86	9.9
20	1.38	80.0	0.85	9.4	0.67	2.40	0.84	8.9
21	1.96	207.0	0.82	8.0	0.65	1.90	0.80	7.0
22	1.32	68.0	0.80	7.0	0.64	1.68	0.87	10.4
23	1.37	78.0	0.77	5.7	0.68	2.70	1.84	181.0
24	1.04	23.0	0.75	4.8	0.78	6.10	1.26	55.0
25	1.04	23.0	0.73	4.2	1.10	30.00	1.07	26.0
26	0.95	14.9	0.69	2.9	1.35	74.00	0.97	16.6
27	1.39	82.0	0.68	2.7	2.17	253.00	0.91	12.6
28	1.31	65.0	0.71	3.5	2.38	300.00	0.90	12.0
29	1.09	28.0	0.75	4.8	2.44	313.00	0.88	11.0
30	0.90	12.0	0.77	5.7	2.59	346.00	1.73	157.0
31	0.94	14.3	.....	.....	1.66	141.00	.....	.....

b Ice conditions; thin ice over creek does not affect the discharge.

DAILY GAUGE HEIGHT AND DISCHARGE of Gap creek at Small's ranch, for 1916.—*Concluded.*

Day	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.25	53.0	0.63	1.46	0.56	0.40	0.59	0.70
2	1.02	21.0	0.60	0.80	0.54	0.24	0.59	0.70
3	1.05	24.0	0.59	0.70	0.54	0.24	0.64	1.68
4	1.32	68.0	0.57	0.50	0.57	0.50	0.71	3.50
5	1.06	25.0	0.55	0.30	0.57	0.50	0.71	3.50
6	0.95	14.9	0.58	0.60	0.57	0.50	0.82	8.00
7	0.90	12.0	0.56	0.40	0.57	0.50	0.87	10.40
8	1.42	88.0	0.55	0.30	0.57	0.50	0.85	9.40
9	1.25	53.0	0.65	2.20	0.57	0.50	0.82	8.00
10	1.10	30.0	1.11	31.00	0.57	0.50	0.77	5.70
11	1.00	19.1	0.86	9.90	0.55	0.30	0.77	5.70
12	0.95	14.9	0.81	7.50	0.55	0.30	0.82	8.00
13	0.90	12.0	0.76	5.20	0.54	0.24	0.82	8.00
14	0.84	8.9	0.71	3.50	0.54	0.24	0.81	7.50
15	0.84	8.9	0.65	1.90	0.54	0.24	0.79	6.60
16	0.78	6.1	0.64	1.68	0.54	0.24	0.77	5.70
17	0.82	8.0	0.62	1.24	0.54	0.24	0.75	4.80
18	0.83	8.4	0.77	5.70	0.54	0.24	0.73	4.20
19	0.88	11.0	0.68	2.70	0.54	0.24	0.72	3.80
20	0.84	8.9	0.67	2.40	0.54	0.24	0.72	3.80
21	0.76	5.2	0.65	1.90	0.54	0.24	0.71	3.50
22	0.71	3.5	0.64	1.68	0.53	0.18	0.70	3.20
23	0.71	3.5	0.61	1.02	0.53	0.18	0.71	3.50
24	0.69	2.9	0.60	0.80	0.53	0.18	0.71	3.50
25	0.66	2.2	0.58	0.60	0.53	0.18	0.72	3.80
26	0.67	2.4	0.58	0.60	0.53	0.18	0.72	3.80
27	0.80	7.0	0.57	0.50	0.57	0.50	0.72	3.80
28	0.81	7.5	0.57	0.50	0.56	0.40	0.72	3.80
29	0.77	5.7	0.57	0.50	0.55	0.30	0.72	3.80
30	0.72	3.8	0.57	0.50	0.61	1.02	0.71	3.50
31	0.67	2.4	0.57	0.50			0.71	3.50

MONTHLY DISCHARGE of Gap creek at Small's ranch, for 1916

(Drainage area 108 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (8-31)	333.00	12.00	79.00	0.731	0.65	3,760
April	34.00	2.70	13.50	0.125	0.14	803
May	346.00	1.68	50.00	0.463	0.53	3,074
June	482.00	7.00	72.00	0.667	0.74	4,284
July	88.00	2.20	17.50	0.162	0.19	1,076
August	31.00	0.30	2.90	0.027	0.03	178
September	1.02	0.18	0.34	0.003	0.00	20
October	10.40	0.70	4.80	0.044	0.05	295
The period					2.33	13,490

MEAN MONTHLY DISCHARGE in Second-feet of Gap creek at Small's ranch

MONTH	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	0.01	Nil	4.40	0.08	Nil	21.00	1.35	4.8	3.96	245
Nov.	.....	.....	.....	3.30*d*	0.41*f*	.....	.....	.....	.....	.....	.....
Dec.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Feb.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
March	.....	.....	57.00*c*	.....	.....	57.00*h*	266.00*k*	79.00*m*	.....	.....	.....
April	58.00*a*	0.52	39.00	88.00*e*	79.00*g*	42.00	71.00	13.50	.....	33.00	1,974
May	52.00	0.16	12.30	15.30	3.40	3.70	8.90	50.00	.....	18.20	1,120
June	30.00*b*	0.01	4.40	2.90	0.70	0.03	72.00	72.00	.....	22.00	1,293
July	7.10	Nil	6.80	Nil	0.58	Nil	19.90	17.50	.....	6.50	399
August	0.71	"	0.80	0.09	0.00	"	5.00	2.90	.....	1.19	73
Sept.	0.00	"	45.00	"	"	1.65	0.07	0.34	.....	5.90	401
Total in Acre-ft.	6,139	43	7,591	6,191	4,743	5,797	19,291	13,278	.....	.....	5,505

a 24-30.
b 1-19 and 22-30.
c 22-31.
d 1-15.
e 4-30.
f 1-15.
g 3-30.
h 6-31.
k 18-31.
m 8-31.

WM. SMALL DITCH FROM MCSHANE CREEK

Location.—On the SE. ¼ Sec. 22, Tp. 9, Rge. 27, W. 3rd Mer., 1,500 feet below headgate.
Records available.—From April 15, 1916, to July 4, 1916.
Gauge.—Vertical staff, driven into the bed of the ditch near the left bank. Zero maintained at elevation 95.92 feet since establishment.
Bench-mark.—Permanent iron bench-mark, located on the left bank, five feet below the gauge and two feet from edge of ditch; assumed elevation 100.00 feet.
Channel.—Composed of gravel and sand, slightly shifting.
Discharge measurements.—Made by wading with current-meter or with weir.
Observer.—Wm. Small.
Remarks.—Ditch was used from April 15 to May 30, and from June 20 to July 4, in 1916.

DISCHARGE MEASUREMENTS of Wm. Small ditch from McShane creek, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 26	E. J. Switzer	5.0	1.80	1.04	0.65	1.87
April 26	do	.....	.....	.....	0.50	0.91*w*
April 26	do	.....	.....	.....	0.44	0.62*w*
May 16	do	4.8	1.67	0.69	0.63	1.14
Aug. 24	do	.....	.....	.....	Dry	Nil

w Discharge determined by using an 18-inch weir.

DAILY GAUGE HEIGHT AND DISCHARGE of Wm. Small ditch from McShane creek, for 1916

DAY	April		May		June		July	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1				1.55*e*			0.80	3.10
2			0.60	1.52				4.10*e*
3				1.52*e*				5.00*e*
4			0.60	1.52			1.10*h*	6.00
5				1.49*e*				
6			0.59	1.46				
7			0.59	1.46				
8				1.44*e*				
9				1.42*e*				
10			0.58	1.39				
11			0.55	1.20				
12				1.14*e*				
13			0.53	1.08				
14			0.53	1.08				
15	0.94*h*	4.40		1.00*e*				
16		4.50*e*		0.93*e*				
17		4.60*e*	0.49	0.86				
18	0.98	4.80		0.86*e*				
19		4.30*e*	0.49	0.86				
20		3.80*e*		0.84*e*	0.67*h*	2.00		
21		3.40*e*	0.48	0.82		2.30*e*		
22	0.78	2.90		2.10*e*	0.75	2.60		
23		2.60*e*		3.30*e*		2.90*e*		
24		2.20*e*		4.60*e*		3.20*e*		
25		1.92*e*		5.80*e*	0.84	3.40		
26	0.61	1.59		7.10*e*		3.40*e*		
27		1.59*e*		8.30*e*		3.30*e*		
28	0.61	1.59		9.60*e*		3.30*e*		
29		1.59*e*		10.80*e*		3.20*e*		
30	0.61	1.59	1.68*h*	12.00		3.10*e*		
31								

e Discharge estimated.
h Headgate opened on April 15, closed on May 30; opened on June 20 and closed for season on July 4.

MONTHLY DISCHARGE of Wm. Small ditch from McShane creek, for 1916

MONTH	DISCHARGE IN SECOND-FEET			Total Discharge in Acre-ft.
	Maximum	Minimum	Mean	
April (15-30)	4.8	1.59	3.0	95
May (1-30)	12.0	0.82	3.0	178
June (20-30)	3.4	2.00	3.0	65
July (1-4)	6.0	3.10	4.6	36
The period				374

MAPLE CREEK NEAR MAPLE CREEK

Location.—On the SE. ¼ Sec. 28, Tp. 11, Rge. 26, W. 3rd Mer.
Records available.—May 4, 1910, to October 31, 1916.
Gauge.—Vertical staff; zero of gauge was maintained at 81.64 feet during 1910-11; 81.60 feet during 1912-15 and 83.60 feet since September 17, 1915.
Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.
Channel.—Composed of sand, and liable to shift during floods.

Discharge measurements.—Made from bridge by wading, or with weir, according to stage.

Artificial control.—On May 28, 1915, a control was built fifty feet below the gauge at this station, consisting of timbers jointed so as to form a V notch weir faced in the upstream side with board piling, and securely anchored to the bed of the stream and banks by posts.

Winter flow.—Station discontinued during the winter season.

Observer.—Miss Kate Williams.

DISCHARGE MEASUREMENTS of Maple creek near Maple Creek, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq ft*	*Ft per sec*	*Feet*	*Sec-ft*
Mar. 20	P A Fetterley	9.5	9.43	1.80	1.94	17.00
April 1	E J Switzer	24.5	18.23	0.75	1.82	13.70
April 25	do	22.0	9.68	0.49	1.51	4.70
May 17	do	20.8	8.72	0.28	1.42	2.40
May 30	do	44.4	113.62	0.88	3.54	100.00
June 14	R J McGuinness	40.6	78.79	0.78	2.80	62.00
June 19	E J Switzer	23.5	17.16	0.59	1.53	10.30
July 15	do	.....	.....	.....	0.45	0.57*w*
July 27	do	.....	.....	.....	0.48	0.57*w*
Aug. 10	do	11.1	4.32	1.09	0.88	4.70
Sept. 28	do	5.0	1.35	0.36	0.45	0.48
Nov. 3	do	4.8	1.09	0.86	0.46	0.94

w Discharge determined by using an 18-inch weir.

DAILY GAUGE HEIGHT AND DISCHARGE of Maple creek near Maple Creek, for 1916

Day	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	1.82	13.4	1.53	5.4	2.34	32.0
2	.....	.....	.....	13.7*e*	1.53	5.4	2.34	32.0
3	.....	.....	1.84	14.0	1.53	5.4	2.29	30.0
4	.....	.....	1.74	11.0	1.43	2.9	2.29	30.0
5	.....	.....	1.71	10.2	1.43	2.9	2.29	30.0
6	.....	.....	1.65	8.5	1.47	3.9	5.15	207.0
7	.....	.....	1.64	8.2	1.47	3.9	4.33	153.0
8	.....	.....	1.63	8.0	1.47	3.9	2.85	57.0
9	3.31*b*	22.0	1.74	11.0	1.47	3.9	2.34	32.0
10	4.01	35.0	1.86	14.6	1.47	3.9	.....	100.0*e*
11	4.62	45.0	1.95	17.5	1.47	3.9	.....	168.0*e*
12	4.50	42.0	2.12	23.0	1.47	3.9	5.59	236.0
13	4.21	37.0	2.12	23.0	1.47	3.9	4.19	144.0
14	3.01*b*	20.0	2.09	22.0	1.44	3.2	2.80	62.0
15	2.21	27.0	.....	19.7*e*	1.44	3.2	2.24	34.0
16	2.41	35.0	1.95	17.5	1.44	3.2	2.09	28.0
17	2.07	22.0	1.84	14.0	1.42	2.7	1.94	22.0
18	1.91	16.2	1.72	10.5	1.44	3.2	1.53	10.4
19	2.10	23.0	1.72	10.5	1.44	3.2	1.53	10.4
20	1.94	17.2	1.75	11.3	1.44	3.2	1.27	5.8
21	.....	18.0*e*	1.73	10.7	1.43	2.9	1.27	5.8
22	.....	18.8*e*	1.73	10.7	1.43	2.9	.....	7.2*e*
23	2.01	19.5	.....	8.7*e*	1.43	2.9	1.44	8.5
24	2.02	19.9	.....	6.8*e*	.....	12.3*e*	1.44	8.5
25	2.05	21.0	1.51	4.9	.....	22.0*e*	1.44	8.5
26	2.05	21.0	1.52	5.1	2.32	31.0	2.15	30.0
27	2.13	24.0	1.52	5.1	1.52	5.1	1.75	15.9
28	2.23	28.0	1.52	5.1	1.52	5.1	1.75	15.9
29	2.34	32.0	1.53	5.4	.....	41.0*e*	1.75	15.9
30	2.04	21.0	1.53	5.4	3.54	101.0	1.75	15.9
31	1.84	14.0	.....	.....	3.50	98.0	.....	.....

b-b Ice conditions from Mar. 9 to 14; discharge estimated.

e Discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of Maple creek near Maple Creek, for 1916—*Concluded*

Day	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec-ft*	*Feet*	*Sec-ft*	*Feet*	*Sec-ft*	*Feet*	*Sec-ft*
1	1.74	15.60	0.61	0.88	0.40	0.44	0.45	0.52
2	.....	14.40*e*	0.61	0.88	0.40	0.44	.....	0.68*e*
3	.....	13.20*e*	0.61	0.88	0.40	0.44	.....	0.84*e*
4	1.60	12.00	0.61	0.88	0.40	0.44	.....	1.01*e*
5	1.34	6.80	0.61	0.88	0.40	0.44	0.70	1.18
6	1.29	6.10	0.60	0.85	0.40	0.44	0.72	1.27
7	1.29	6.10	0.60	0.85	0.40	0.44	0.69	1.14
8	1.04	3.30	0.60	0.85	0.40	0.44	0.52	0.65
9	1.04	3.30	0.60	0.85	0.40	0.44	0.50	0.61
10	1.04	3.30	0.88	2.10	0.40	0.44	0.47	0.56
11	1.04	3.30	0.60	0.85	0.40	0.44	0.41	0.46
12	1.04	3.30	0.60	0.85	0.40	0.44	0.41	0.46
13	1.04	3.30	0.60	0.85	0.40	0.44	0.41	0.46
14	.....	1.91*e*	0.60	0.85	0.39	0.43	0.41	0.46
15	0.45	0.52	0.60	0.85	0.39	0.43	0.41	0.46
16	0.45	0.52	0.60	0.85	0.39	0.43	0.41	0.46
17	0.45	0.52	.....	0.85*e*	0.40	0.44	0.40	0.44
18	0.52	0.65	0.60	0.85	0.40	0.44	0.40	0.44
19	0.55	0.72	0.60	0.85	0.40	0.44	0.40	0.44
20	0.55	0.72	0.60	0.85	0.40	0.44	0.40	0.44
21	0.56	0.75	0.60	0.85	0.40	0.44	0.40	0.44
22	0.56	0.75	0.52	0.65	0.40	0.44	0.40	0.44
23	0.56	0.75	0.52	0.65	0.40	0.44	0.40	0.44
24	0.49	0.59	0.50	0.61	0.40	0.44	0.40	0.44
25	0.45	0.52	0.45	0.52	0.40	0.44	0.40	0.44
26	0.42	0.47	0.45	0.52	0.40	0.44	0.40	0.44
27	0.48	0.57	0.45	0.52	.....	0.48*e*	0.40	0.44
28	0.50	0.61	0.45	0.52	0.45	0.52	0.40	0.44
29	.....	0.76*e*	0.45	0.52	0.45	0.52	0.40	0.44
30	0.62	0.91	0.43	0.49	0.45	0.52	0.40	0.44
31	0.62	0.91	0.41	0.46	.....	.....	0.40	0.44

e Discharge estimated.

MONTHLY DISCHARGE of Maple creek near Maple Creek, for 1916

(Drainage area 82 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March (9-31)	45.00	14.00	25.00	0.305	0.26	1,140
April	23.00	4.90	11.60	0.141	0.16	690
May	101.00	2.70	12.90	0.157	0.18	793
June	236.00	5.80	52.00	0.634	0.71	3,094
July	15.60	0.47	3.40	0.041	0.05	209
August	2.10	0.46	0.80	0.010	0.01	49
September	0.52	0.43	0.45	0.005	0.01	27
October	1.27	0.44	0.56	0.007	0.01	34
The period	.....	.....	.....	.....	1.39	6,036

MEAN MONTHLY DISCHARGE in Second-feet of Maple creek near Maple Creek

MONTH	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	0.03	Nil	1.20	0.15	Nil	16.30	0.36	0.56	2.30	143
November	.....	.....	.....	1.00*f*	0.14*g*	.....	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
March	8.50*a*	.....	52.00*c*	.....	.....	38.00*h*	86.00*k*	25.00*m*	.....	.....	.....
April	35.00	0.99	45.00	70.00	53.00	20.00	25.00	11.60	.....	33.00	1,944
May	38.00	0.18	8.70	16.80	4.00	2.60	2.10	12.90	.....	10.70	657
June	29.00*b*	0.13	5.60*d*	11.50	0.54	0.20	8.30	52.00	.....	12.10	721
July	13.80	0.03	Nil*e*	0.53	0.42	0.21	17.90	3.40	.....	5.20	319
August	0.12	0.02	Nil	3.30	0.12	1.25	0.29	0.80	.....	0.74	45
September	0.03	0.01	0.90	0.19	0.09	0.84	0.55	0.45	.....	0.38	23
Total in acre-ft.	6,955	84	4,467	6,196	3,492	2,963	6,145	6,024	.....	.....	3,852

a 29-31.
b 1-19; 22-30.
c 23-31.
d 1-23.
e 27-31.
f 1-4.
g 1-15.
h 13-31.
k 21-31.
m 9-31.
Prior to 1912 records taken at Maple creek (16-11-16-3), drainage area 81 square miles.

MAPLE CREEK AT DIXON'S RANCH

Location.—On the NE. ¼ Sec. 5, Tp. 12, Rge. 26, W. 3rd Mer., at Joseph Dixon's ranch, four miles north and one mile west of the town of Maple Creek.

Records available.—May 1 to October 31, 1916.

Gauge.—Vertical staff nailed to a 4-inch by 4-inch post driven into the bed of the stream near the right bank and braced by two pieces 2 inches by 4 inches to the right bank, 150 feet up stream from the natural rock control and trail crossing. Zero elevation maintained at 89.92 feet since establishment.

Bench-mark.—Permanent iron bench-mark forty feet west of gauge; assumed elevation 100.00 feet.

Channel.—Practically permanent and with channel at all stages composed of clay and rock.

Discharge measurements.—Made by wading or from highway bridge three-quarters mile up stream during flood stage.

Winter flow.—Station discontinued during winter season.

Observer.—Miss Agnes Dixon.

DISCHARGE MEASUREMENTS of Maple creek at Dixon's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 21	E. J. Switzer	43.0	128.00	2.59	3.75	333.00
April 1	do	37.0	40.69	0.98	2.50	40.00
April 24	do	18.0	23.75	0.72	2.10	17.20
May 17	do	17.9	19.34	0.39	1.88	7.60
May 30	do	48.3	163.46	2.61	4.32	426.00
June 14	R. J. McGuinness	35.3	90.93	2.20	3.41	200.00
June 19	E. J. Switzer	18.3	30.62	1.25	2.41	38.90
July 15	do	18.5	21.53	0.40	2.01	8.60
July 26	do	18.5	19.35	0.36	1.84	7.00
Aug. 15	do	18.2	20.28	0.36	1.88	7.30
Sept. 28	do	6.0	3.10	0.48	1.61	1.50
Nov. 3	do	7.8	3.94	1.86	1.81	7.20

DAILY GAUGE HEIGHT AND DISCHARGE of Maple creek at Dixon's ranch, for 1916

DAY	March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.80*b*	40	2.50	43.0	2.03	12.9	4.54	559
2	3.34	35	2.48	41.0	2.02	12.5	.....	328*e*
3	3.00	30	2.45	38.0	2.01	12.2	2.92	97
4	2.82	25	.....	33.0*e*	.....	12.2*e*	2.84	85
5	2.71	20	2.34	29.0	2.01	12.2	2.72	68
6	2.69	20	.....	34.0*e*	2.01	12.2	4.82	662
7	2.65*b*	75	.....	39.0*e*	2.01	12.2	3.84	318
8	2.97	106	.....	44.0*e*	1.96	10.4	3.11	132
9	3.70	275	.....	48.0*e*	1.94	9.7	2.65	59
10	.....*f*	808*e*	.....	52.0*e*	1.89	8.1	2.72	68
11	.....	700*e*	2.62	56.0	1.87	7.6	3.91	340
12	.....	600*e*	2.65	59.0	.....	7.1*e*	7.21	1,612
13	.....	500*e*	2.60	54.0	1.84	6.7	4.11	407
14	.....	400*e*	2.55	48.0	1.83	6.4	3.41	199
15	.....	250*e*	2.56	49.0	1.82	6.2	2.98	107
16	.....	100*e*	2.58	51.0	.....	7.0*e*	2.69	64
17	.....	80*e*	2.51	44.0	1.88	7.8	2.66	60
18	.....	65*e*	.....	33.0*e*	1.87	7.6	2.68	63
19	2.65*f*	59	2.22	22.0	1.90	8.4	2.41	35
20	2.64	58	2.21	21.0	1.86	7.3	2.50	43
21	3.75	290	2.20	20.0	.....	7.0*e*	2.31	27
22	3.99	367	2.15	17.8	1.84	6.7	2.29	26
23	3.35	185	2.11	16.0	1.83	6.4	3.25	162
24	.....	130*e*	2.10	15.6	1.84	6.7	3.75	290
25	2.78	76	2.12	16.5	1.92	9.0	2.63	57
26	2.80	79	2.05	13.6	2.83	83.0	2.70	65
27	2.72	68	1.97	10.7	3.82	311.0	2.69	64
28	3.15	140	1.96	10.4	4.72	624.0	2.41	35
29	.....	106*e*	1.97	10.7	4.52	552.0	2.29	26
30	2.75	72	2.02	12.5	4.32	480.0	3.25	162
31	2.64	58	.....	.....	4.55	563.0	.....	.....

b-b Ice conditions; discharge estimated.
e Discharge estimated.
Gauge washed out March 10; re-installed March 19.

DAILY GAUGE HEIGHT AND DISCHARGE of Maple creek at Dixon's ranch, for 1916.—*Concluded.*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	3.85	321.0	1.87	7.60	1.60	1.30	1.54	0.72
2	2.82	82.0	1.86	7.30	1.58	1.10	1.58	1.10
3	2.52	45.0	1.85	7.00	1.57	1.00	.....	2.00*e*
4	2.66	60.0	1.79	5.30	1.61	1.48	1.69	3.00
5	2.80	79.0	1.70	3.20	1.63	1.84	1.76	4.60
6	2.74	71.0	1.68	2.80	1.62	1.66	.....	5.60*e*
7	2.42	36.0	1.66	2.40	1.57	1.00	1.84	6.70
8	2.30	26.0	1.65	2.20	1.57	1.00	1.88	7.80
9	2.41	35.0	2.11	16.00	1.56	0.90	2.01	12.20
10	2.50	43.0	2.23	22.00	1.48	0.32	1.92	9.00
11	2.39	33.0	2.52	45.00	1.54	0.72	1.87	7.60
12	2.30	26.0	2.21	21.00	1.53	0.64	1.85	7.00
13	2.22	21.0	2.02	12.50	1.52	0.56	1.81	5.90
14	2.01	12.2	1.87	7.60	1.52	0.56	1.87	7.60
15	2.00	11.8	1.88	7.80	1.52	0.56	1.87	7.60
16	1.96	10.4	1.81	5.90	1.53	0.64	1.87	7.60
17	1.94	9.7	1.87	7.60	1.54	0.72	1.86	7.30
18	1.92	9.0	1.84	6.70	1.52	0.56	1.84	6.70
19	1.90	8.4	1.82	6.20	.....	0.52*e*	1.80	5.60
20	1.87	7.6	1.76	4.60	1.51	0.48	1.83	6.40
21	1.90	8.4	1.74	4.10	.....	0.48*e*	1.81	5.90
22	1.82	6.2	1.72	3.60	1.51	0.48	1.79	5.30
23	1.80	5.6	1.71	3.40	1.50	0.40	1.77	4.80
24	1.79	5.3	1.70	3.20	1.51	0.48	1.78	5.10
25	1.79	5.3	1.69	3.00	1.51	0.48	1.82	6.20
26	1.84	6.7	1.68	2.80	1.51	0.48	.....	6.00*e*
27	1.87	7.6	1.67	2.60	1.51	0.48	1.81	5.90
28	1.89	8.1	1.66	2.40	1.61	1.48	1.83	6.40
29	1.92	9.0	1.64	2.00	.....	1.15*e*	1.85	7.00
30	1.90	8.4	1.62	1.66	1.57	1.00	1.87	7.60
31	1.88	7.8	1.61	1.48	.....	.....	1.85	7.00

e Discharge estimated.

MONTHLY DISCHARGE of Maple creek at Dixon's ranch, for 1916

(Drainage area 375 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
March	808.00	20.00	192.00	0.512	0.59	11,806
April	59.00	10.40	33.00	0.089	0.10	1,964
May	624.00	6.20	92.00	0.245	0.28	5,657
June	1,612.00	26.00	207.00	0.552	0.62	12,317
July	321.00	5.30	33.00	0.089	0.10	2,029
August	45.00	1.48	7.40	0.020	0.02	455
September	1.84	0.32	0.82	0.002	0.00	49
October	12.20	0.72	6.10	0.016	0.02	375
The period	.....	.....	.....	.....	1.73	34,652

DIXON DITCH FROM MAPLE CREEK

Location.—On the SE. ¼ Sec. 17, Tp. 12, Rge. 26, W. 3rd Mer.

Records available.—Incomplete data for 1915-16.

Gauge.—Vertical staff situated at the headgate; zero maintained at elevation 95.88 feet since establishment to April 2, 1916, when it was changed to 95.13 feet.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—One channel, clay bed.

Discharge measurements.—Made with current-meter or weir.

Observer.—Joseph Dixon.

Remarks.—This station was established on June 4, 1911. Records show that water was used in irrigation season of 1915 and 1916, but no data was obtained during 1915 and not sufficient discharge measurements obtained in 1916 to plot a discharge curve. Water was used for twenty-eight days between April 2 and May 6, 1916. Estimated average discharge, 4.0 second-feet.

DISCHARGE MEASUREMENTS of Dixon ditch from Maple creek, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 24	E. J. Switzer	11.2	5.33	0.71	1.00	3.8
Aug. 15	do				Dry	Nil

MISCELLANEOUS DISCHARGE MEASUREMENTS made in Bigstick lake drainage basin, in 1916

Date	Engineer	Stream	Location	Width	Area of Section	Mean Velocity	Discharge
				Feet	*Sq. ft.*	*Ft. per sec.*	*Sec.-ft.*
May 17	E. J. Switzer	Gap creek	NE. 28-11-26-3	10.3	6.51	0.55	3.60
May 30	do	do	SE. 30-11-26-3	47.0	205.00	1.96	403.00
June 14	R. J. McGuinness	do	do	47.5	113.00	1.21	136.00
June 19	E. J. Switzer	do	NE. 28-11-26-3	15.9	22.00	1.01	22.00
July 15	do	do	do	12.4	7.88	0.95	7.50
July 27	do	do	do	7.4	5.32	0.73	3.90
Aug. 10	do	do	do	11.2	13.90	0.92	12.80
Mar. 22	P. A. Fetterley	McShane creek	SE. 4-10-27-3	5.6	9.10	1.43	13.00
April 25	E. J. Switzer	do	do				0.65*w*
May 16	do	do	do				0.08*w*
June 1	do	do	do	16.0	10.10	0.69	7.00
July 6	do	do	do	5.2	1.40	0.47	0.67
July 28	do	do	do	5.5	2.50	0.60	1.51
Aug. 23	do	do	do				Nil

w Discharge determined by using an 18-inch weir.

MANY ISLAND LAKE DRAINAGE BASIN

General Description

Many Island lake is about twenty-five square miles in area, and is situated on the boundary line between the provinces of Alberta and Saskatchewan, about ten miles north of the town of Walsh. It is the farthest west of the several lakes which receive the drainage of the northern slope of the Cypress hills. The lake is shallow and alkaline. Its only source of water supply is Mackay creek with its tributaries, Stony and Boxelder creeks.

The topography of the basin is very rough and the creek slopes are heavy. The basin is bare of trees except in the hills near the sources of the streams. The creek channels are deep and the beds are mostly gravel.

As is the case in all prairie basins the highest discharges occur in April. Usually all the streams of this drainage basin stop running in June or July and generally remain so for the remainder of the season.

In the lower part of the drainage basin near the lake, irrigation has been developed to some extent in hay meadows. In the upper part there are few irrigation schemes.

MACKAY CREEK AT WALSH

Location.—On NW. ¼ Sec. 26, Tp. 11, Rge. 1, W. 4th Mer., at traffic bridge.

Records available.—July 29, 1909, to October 31, 1916.

Gauge.—Vertical staff; elevation 2,432.65 feet above sea-level, maintained since establishment.

Bench-mark.—Permanent iron bench-mark; elevation 2,443.73 feet above mean sea-level (Geodetic Survey of Canada.)

Channel.—Composed of clay.

Discharge measurements.—Made from bridge, wading or with a weir.

Floods.—On June 13, 1916, this stream overflowed its banks at the town of Walsh and caused considerable damage. This rise was due to excessive rainfall at the headwaters.

Winter flow.—Station not maintained during winter.

Observer.—Edward Sept.

DISCHARGE MEASUREMENTS of Mackay creek at Walsh, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 3	E. J. Switzer	12.5	13.52	0.96	1.18	13.00*n*
April 19	do	12.0	9.83	0.89	1.05	8.80*n*
May 18	do	14.0	22.12	0.22	0.89	5.00
May 29	do	57.2	173.96	1.26	4.67	219.00
June 13	R. J. McGuinness	59.5	222.75	1.37	5.39	306.00
June 13	do	63.5	580.95	3.16	11.34	1,836.00*nx*
June 20	E. J. Switzer	15.0	35.44	0.71	1.62	25.00
June 29	do	16.0	39.65	0.67	1.72	27.00
July 17	do	10.8	7.34	0.41	0.56	3.10*n*
July 25	do	11.7	7.82	0.40	0.61	3.10*n*
Aug. 16	do	11.8	9.35	0.58	0.73	5.00*n*
Aug. 22	do	12.3	9.82	0.59	0.77	6.00*n*
Sept. 26	do	11.2	4.97	0.15	0.32	0.75*n*
Nov. 2	do	9.8	4.66	0.98	0.67	4.60*n*

n Discharge measured at miscellaneous sections.
x Slope measurement.

DAILY GAUGE HEIGHT AND DISCHARGE of Mackay creek at Walsh, for 1916

DAY	February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			1.28	14.60	0.24	0.66	0.87	6.4	3.99	153
2			0.88	6.50	0.24	0.66	0.88	6.5	3.45	111
3			1.14	11.00	1.18*f*	12.00	1.04	8.9	2.99	83
4			1.22	13.00	1.16	11.50	1.00	8.3	2.46	56
5			1.33	15.90	1.09	9.90	1.00	8.3	2.65	65
6			1.46	19.70	1.06	9.30	0.93	7.2	7.78	807
7			1.56	23.00	1.04	8.90	0.93	7.2	4.61	213
8			1.15	11.20	1.00	8.30	0.86	6.2	3.03	85
9			2.65	65.00	1.04	8.90	0.88	6.5	2.43	54
10			2.80	72.00	1.16	11.50	0.80	5.5	2.55	60
11			6.51	507.00	1.31	15.40	0.76	5.0	10.00	1,447
12			5.41	312.00	1.36	16.80	0.74	4.8	9.74	1,372
13			3.98	152.00	1.34	16.20	0.74	4.8	5.11	270
14			2.65	65.00	1.23	13.30	0.75	4.9	3.58	120
15			1.89	33.00	1.26	14.10	0.76	5.0	2.98	82
16			0.98	8.00	1.27	14.30	0.81	5.6	2.61	63
17			1.08	9.70	1.18	12.00	0.81	5.6	2.28	48
18			1.62	24.00	1.12	10.50	0.89	6.7	2.04	38
19			1.21	12.80	1.05	9.10	0.82	5.7	1.72	28
20			1.46	19.70	1.02	8.60	0.78	5.3	1.62	24
21	3.30	102.0	2.04	38.00	0.98	8.00	0.70	4.3	1.50	21
22	2.70	68.0	1.72	28.00	0.94	7.40	0.69	4.2	1.58	23
23	2.72	68.0	1.31	15.40	0.89	6.70	0.82	5.7	3.61	123
24	1.88	33.0	0.81	5.60	0.84	6.00	0.87	6.4	3.45	111
25	1.80	30.0	0.71	4.40	0.80	5.50	1.68	26.0	2.54	60
26	1.65	25.0	0.58	3.10	0.77	5.10	2.91	78.0	2.10	41
27	1.53	22.0	0.60	3.30	0.77	5.10	5.68	354.0	1.98	36
28	1.40	17.9	0.88	6.50	0.77	5.10	5.09	268.0	1.92	34
29	1.44	19.1	0.81	5.60	0.89	6.70	4.67	220.0	1.72	28
30			0.53	2.60	0.89	6.70	8.60	1,041.0	2.84	75
31			0.32	1.12			6.19	444.0		

f Gauge replaced.

DAILY GAUGE HEIGHT AND DISCHARGE of Mackay creek at Walsh, for 1916—*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.77	71.0	0.75	4.90	0.47	2.20	0.44	1.92
2	1.83	31.0	0.63	3.60	0.45	2.00	0.49	2.30
3	2.17	43.0	0.56	2.90	0.46	2.10	0.60	3.30
4	4.00	154.0	0.50	2.40	0.48	2.20	0.68	4.10
5	2.78	72.0	0.49	2.30	0.54	2.70	0.69	4.20
6	1.89	33.0	0.44	1.92	0.73	4.70	0.74	4.80
7	1.52	22.0	0.41	1.68	0.71	4.40	1.09	9.90
8	1.70	27.0	0.37	1.42	0.66	3.90	1.10	10.10
9	1.81	31.0	1.43	18.80	0.60	3.30	0.95	7.50
10	1.63	25.0	3.29	101.00	0.56	2.90	0.84	6.00
11	1.17	11.7	2.36	51.00	0.52	2.60	0.82	5.70
12	1.04	8.9	1.66	26.00	0.49	2.30	0.85	6.10
13	0.91	6.9	1.29	14.80	0.48	2.20	0.88	6.50
14	0.80	5.5	1.04	8.90	0.48	2.20	0.89	6.70
15	0.69	4.2	0.88	6.50	0.47	2.20	0.86	6.20
16	0.65	3.8	0.73	4.70	0.50	2.40	0.77	5.10
17	0.56	2.9	0.84	6.00	0.48	2.20	0.75	4.90
18	0.63	3.6	2.48	57.00	0.43	1.84	0.75	4.90
19	1.22	13.0	1.86	32.00	0.39	1.54	0.74	4.80
20	1.27	14.3	1.37	17.10	0.38	1.48	0.70	4.30
21	1.05	9.1	1.07	9.50	0.37	1.42	0.70	4.30
22	0.87	6.4	0.77	5.10	0.33	1.18	0.73	4.70
23	0.75	4.9	0.68	4.10	0.33	1.18	0.76	5.00
24	0.66	3.9	0.61	3.40	0.33	1.18	0.76	5.00
25	0.61	3.4	0.58	3.10	0.31	1.06	0.72	4.50
26	0.68	4.1	0.58	3.10	0.32	1.12	0.77	5.10
27	1.74	28.0	0.57	3.00	0.27	0.82	0.76	5.00
28	2.01	37.0	0.59	3.20	0.34	1.24	0.80	5.50
29	1.41	18.2	0.58	3.10	0.40	1.60	0.89	6.70
30	1.12	10.5	0.54	2.70	0.44	1.92	0.86	6.20
31	0.92	7.1	0.49	2.30	.....	.....	0.79	5.40

MONTHLY DISCHARGE of Mackay creek at Walsh, for 1916

(Drainage area 200 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
February (21-29)	102.0	17.90	43.0	0.215	0.07	768
March	507.0	1.12	49.0	0.245	0.28	3,013
April	16.8	0.66	9.1	0.046	0.05	542
May	1,041.0	4.20	83.0	0.415	0.48	5,103
June	1,447.0	21.00	191.0	0.955	1.07	11,365
July	154.0	2.90	23.0	0.115	0.13	1,414
August	101.0	1.42	13.1	0.066	0.08	806
September	4.7	0.82	2.1	0.010	0.01	125
October	10.1	1.92	5.4	0.027	0.03	332
The period	.....	.....	.....	.....	2.20	23,468

MEAN MONTHLY DISCHARGE in Second-feet of Mackay creek at Walsh

MONTH	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October		4.40	Nil	Nil	10.80	1.52	5.4	3.7	226
November		2.90*a*	"						
December									
January									
February						43.00*f*			
March	22.00*b*	271.00*c*		9.30*d*	82.00*e*	49.00		49.0	3,013
April	22 00	88.00	43 00	21.00	26.00	9.10		35.0	2,076
May	8.20	23.00	9.40	3.00	14.20	83.00		23.0	1,439
June	1.74	5.40	0.03	Nil	87.00	191.00		48.0	2,829
July	7.80	0.03	Nil	"	14.50	23.00		7.6	465
August	0.00	Nil	"	"	5.10	13.10		3.0	187
September	30.00	"	"	0.33	0.10	2.10		5.4	357
Total in acre-ft.	4,798	10,517	3,143	1,993	12,066	23,229			10,592

a 1-8.
b 19-31.
c 26-31.
d 11-31.
e 16-31.
f 21-29.

BOXELDER CREEK AT YOUNG'S RANCH

Location.—On the NE. ¼ Sec. 2, Tp. 12, Rge. 30, W. 3rd Mer., two miles east of Walsh.
Records available.—March 11, 1911, to October 31, 1916. Discharge measurements only, 1909-10.
Gauge.—Vertical staff; elevation of zero maintained at 88.83 feet since establishment.
Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.
Channel.—Clay.
Discharge measurements.—Made with current-meter; by wading during low stages and from railway bridge down stream during flood stages.
Winter flow.—Station not maintained during the winter.
Observer.—John Young.

DISCHARGE MEASUREMENTS of Boxelder creek at Young's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 3	E. J. Switzer	9.5	4.59	0.45	0.88	2.00
April 20	do				0.72	0.55*w*
May 18	do				Dry	Nil
May 29	do	50.6	157.00	0.68		106.00
June 13	R. J. McGuinness	60.0	257.00	0.88	7.30	225.00*x*
June 13	do	47.0	144.00	0.87	5.15	125.00
June 20	E. J. Switzer	11.5	7.45	0.41	1.04	3.00
June 30	do	18.2	31.60	0.85	2.56	27.00
July 17	do				0.28	Nil
Aug. 16	do				0.71	0.53*w*
Sept. 26	do				Dry	Nil
Nov. 2	do				0.74	0.65*e*

e Discharge estimated.
w Discharge determined by using an 18-inch weir.
x Slope measurement.

DAILY GAUGE HEIGHT AND DISCHARGE of Boxelder creek at Young's ranch, for 1916

DAY	February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	0.99	2.60	0.93	2.10	Dry	Nil	4.12	81.0
2	.....	.....	0.89	1.83	0.83	1.41	0.73	0.85	2.67	30.0
3	.....	.....	0.89	1.83*i*	0.88	1.76	0.73	0.85	1.87	13.0
4	.....	.....	0.89	1.83	0.83	1.41	0.73	0.85	1.61	9.3
5	.....	.....	0.89	1.83	0.83	1.41	0.78	1.10	1.81	12.1
6	.....	.....	0.89	1.83	0.83	1.41	0.73	0.85	2.70	30.0
7	.....	.....	0.89	1.83	0.83	1.41	0.73	0.85	5.40	137.0
8	.....	.....	0.89	1.83*i*	0.83	1.41	0.70	0.70	3.59	59.0
9	.....	.....	2.19	10.00*b*	0.78	1.10	0.68	0.64	1.74	11.1
10	.....	.....	4.34	50.00	0.73	0.85	0.63	0.49	1.58	8.9
11	.....	.....	4.94	75.00	0.83	1.41	0.58	0.36	4.55	99.0
12	.....	.....	6.69	125.00	0.98	2.50	0.58	0.36	7.31	226.0
13	.....	.....	5.64	90.00*b*	0.88	1.76	0.43	0.06	5.35	134.0
14	.....	.....	3.69	63.00	0.88	1.76	0.36	Nil	3.51	56.0
15	11.26	329.0*e*	2.23	19.80	0.88	1.76	0.28	"	2.07	16.6
16	9.15*a*	250.0*e*	1.83	12.30	0.88	1.76	Dry	"	1.63	9.6
17	7.04	213.0	1.43	7.10	0.88	1.76	"	"	1.39	6.6
18	5.69	150.0	1.53	8.30	0.86	1.62	"	"	1.26	5.1
19	4.59	101.0	1.43	7.10	0.78	1.10	"	"	1.18	4.3
20	3.89	71.0	1.48	7.70	0.72	0.80	"	"	1.04	3.0
21	3.09	42.0	2.23	19.80	0.68	0.64	0.33	"	1.04	3.0
22	3.04	40.0	2.58	28.00	0.63	0.49	0.73	0.85	0.99	2.6
23	2.54	27.0	1.93	14.00	0.60	0.40	0.83	1.41	1.19	4.4
24	2.19	19.0	1.58	8.90	0.53	0.26	0.98	2.50	2.64	29.0
25	1.59	9.1	1.63	9.60	0.33	Nil	1.13	3.80	2.84	34.0
26	1.64	9.7	1.38	6.50	Dry	"	2.28	21.00	2.94	37.0
27	1.39	6.6	1.13	3.80	"	"	3.63	61.00	2.64	29.0
28	1.34	6.0	1.43	7.10	"	"	5.23	129.00	2.14	18.0
29	1.04	3.0	1.58	8.90	"	"	5.23	129.00	1.59	9.1
30	.....	.....	1.33	5.90	"	"	6.08	168.00	2.56	27.0
31	.....	.....	0.98	2.50	.....	.....	6.43	184.00	.....	.....

a Gauge height interpolated.
b-b Ice conditions; discharge estimated.
e Discharge estimated.
i-i Stream frozen over; does not affect gauge height.

DAILY GAUGE HEIGHT AND DISCHARGE of Boxelder creek at Young's ranch, for 1916—*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.89	36.00	0.59	0.38	Dry	Nil	Dry	Nil
2	2.59	28.00	0.48	0.16	"	"	"	"
3	2.19	19.00	0.38	Nil	"	"	"	"
4	1.74	11.10	0.28	"	"	"	"	"
5	1.69	10.40	Dry	"	"	"	"	"
6	1.39	6.60	"	"	"	"	"	"
7	1.14	3.90	"	"	"	"	"	"
8	0.99	2.60	"	"	"	"	"	"
9	1.09	3.40	0.56	0.32	"	"	1.90	13.50
10	0.99	2.60	3.11	42.00	"	"	1.95	14.40
11	0.89	1.83	2.41	24.00	"	"	1.80	11.90
12	0.77	1.05	1.56	8.70	"	"	1.70	10.50
13	0.69	0.67	1.20	4.50	"	"	1.68	10.20
14	0.64	0.52	1.10	3.50	"	"	1.35	6.10
15	0.44	0.08	0.90	1.90	"	"	1.15	4.00
16	0.29	Nil	0.71	0.75	"	"	0.90	1.90
17	0.28	"	0.80	1.20	"	"	0.90	1.90
18	0.00	"	0.85	1.55	"	"	0.90	1.90
19	1.34	6.40	0.90	1.90	"	"	0.90	1.90
20	1.04	3.00	1.10	3.50	"	"	0.90	1.90
21	0.69	0.67	1.00	2.70	"	"	0.90	1.90
22	0.49	0.18	0.85	1.55	"	"	0.90	1.90
23	0.14	Nil	0.68	0.64	"	"	0.85	1.55
24	0.00	"	0.60	0.40	"	"	0.85	1.55
25	0.00	"	0.50	0.20	"	"	0.85	1.55
26	1.14	3.90	0.40	Nil	"	"	0.80	1.20
27	1.09	3.40	0.30	"	"	"	0.80	1.20
28	1.04	3.00	Dry	"	"	"	0.80	1.20
29	0.94	2.20	"	"	"	"	0.80	1.20
30	0.84	1.48	"	"	"	"	0.75	0.95
31	0.74	0.90	"	"	.....	.....	0.70	0.70

MONTHLY DISCHARGE of Boxelder creek at Young's ranch, for 1916

(Drainage area 104 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
February (15-29)	329.0	3.00	85.00	0.817	0.46	2,528
March	125.0	1.83	19.50	0.188	0.22	1,199
April	2.5	0.00	1.08	0.010	0.01	64
May	184.0	0.00	23.00	0.221	0.25	1,414
June	226.0	2.60	38.00	0.365	0.41	2,261
July	36.0	0.00	4.90	0.047	0.05	301
August	42.0	0.00	3.20	0.031	0.04	197
September	0.0	0.00	0.00	0.000	0.00	000
October	14.4	0.00	3.10	0.030	0.03	191
The period	.....	.....	.....	.....	1.47	8,155

MEAN MONTHLY DISCHARGE in Second-feet of Boxelder creek at Young's ranch

MONTH	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October		1.34*c*	Nil	Nil	3.40	Nil	3.10	1.30	80
November									
December									
January									
February						85.00*b*			
March	18.60*d*			5.00*e*	35.00*a*	19.50		19.50	1,199
April	8.10	17.30	9.80	5.20	8.40	1.08		8.30	494
May	3.60	3.80	0.34	0.38	1.95	23.00		5.50	339
June	1.82	1.00	Nil	Nil	17.80	38.00		9.80	582
July	8.10	Nil	"	"	1.58	4.90		2.40	149
August	0.00	"	"	"	Nil	3.20		0.53	33
September	14.00	"	"	"	"	Nil		2.30	139
Total in acre-ft.	2,927	1,359	602	620	3,109	7,964			3,015

a 16-31.
b 15-29.
c 1-4.
d 11-31.
e 3-31.

D. DRINNAN'S EAST DITCH FROM MCKAY CREEK

Location.—On the SE. ¼ Sec. 23, Tp. 13, Rge. 1 W. 4th Mer., 167 feet below headgate of ditch.
Records available.—For irrigation season of 1916. Established November 11, 1915.
Gauge.—One section of metal rod, 0 to 3 feet, fastened to post driven into bed of ditch at left bank; zero of gauge 96.31, assumed.
Bench-mark.—4-inch by 4-inch by 2 feet post situated on right bank of creek about fifty feet down stream from headgate; assumed elevation 100.00 feet.
Channel.—Ditch is composed of sandy loam.
Discharge measurements.—Made by wading with current-meter or with weir.
Observer.—Dan Drinnan.

DISCHARGE MEASUREMENTS of D. Drinnan's East ditch from McKay creek, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 21	E. J. Switzer	7.7	4.25	0.41	1.91	1.75
April 21	do	8.2	5.71	0.76	2.11	4.40
April 21	do				1.64	1.27*w*
April 21	do				1.51	0.51*w*

w Weir measurement

DAILY GAUGE HEIGHT AND DISCHARGE of D. Drinnan's East ditch from McKay creek, for 1916

APRIL			MAY			MAY			JUNE		
Day	Gauge Height	Discharge	Day	Gauge Height	Discharge	Day	Gauge Height	Discharge	Day	Gauge Height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*
21*b*	2.12	4.40	11	1.86*b*	2.20	25	1.93*b*	2.70	1	2.17	4.90
22	2.13	4.50	12	1.84	2.00	26	1.81	1.85	2	2.23	5.50
23	2.09*a*	4.20	13	1.75	1.50	27	2.24	5.60	3	2.23	5.50
24	2.05	3.80	14	1.63	0.92	28	2.51	8.40	4	2.25	5.70
25	2.04	3.70	15	1.56	0.66	29	2.01	3.40	5	2.25*b*	5.70
26	2.04*b*	3.70	16	1.50*b*	0.49	30	2.05	3.80			
						31	2.09	4.20			

a Gauge height interpolated.
b Headgate opened April 21, closed April 26; opened May 11, closed May 16; opened May 25 and closed June 5.

MONTHLY DISCHARGE of D. Drinnan's East ditch from MacKay creek, for 1916

MONTH	DISCHARGE IN SECOND-FEET			Total Discharge in Acre-ft.
	Maximum	Minimum	Mean	
April (21 to 30)	4.50	3.70	4.00	48
May (11-16 and 25-31)	8.40	0.49	2.90	75
June (1-5)	5.70	4.90	5.50	55
The period				178

MISCELLANEOUS DISCHARGE MEASUREMENTS made in Many Island Lake drainage basin, in 1916

Date	Engineer	Stream	Location	Width	Area of Section	Mean Velocity	Discharge
				Feet	*Sq. ft.*	*Ft. per sec.*	*Sec.-ft.*
May 18	E. J. Switzer	East br. Mackay creek	NW. 14-11-1-4	10.1	8.25	0.73	6.00
June 30	do	do	do	23.5	34.80	2.21	77.00
July 18	do	do	do	12.0	3.90	0.84	3.30
July 25	do	do	do	11.0	3.94	0.47	1.89
May 18	do	West. br. Mackay creek	do				0.28*w*
June 30	do	do	do	8.0	3.62	0.90	3.30
July 18	do	do	do				0.32*w*
July 25	do	do	do				0.29*w*

w Discharge determined by using an 18-inch weir.

ROSS CREEK DRAINAGE BASIN

General Description

Ross creek rises in Elkwater lake, a small body of water covering an area of approximately two square miles, situated in Township 8, Range 3, West of the 4th Meridian. The creek flows in a northerly direction as far as Irvine and then turns sharply to the westward and closely parallels the main line of the Canadian Pacific railway to Medicine Hat. Here it joins Sevenpersons river and the combined stream flows into the South Saskatchewan in Section 32, Township 12, Range 5, West of the 4th Meridian. The tributaries of Ross creek are Bullshead, which joins it in Section 21, Township 12, Range 5, West of the 4th Meridian, and Gros Ventre creek, which joins it in Section 14, Township 11, Range 3, West of the 4th Meridian.

The topography of this basin is exceedingly rough and rolling, and almost totally devoid of tree growth. The one exception is a small area of the forest reserve just south of Elkwater lake, which has a good stand of pine and spruce.

The Canadian Pacific Railway takes the water supply for its tank at Irvine from Ross creek and there are also several small irrigation schemes taking their supply from this stream and its tributaries.

MISS A. H. BROWN DITCH FROM GROS VENTRE CREEK

Location.—On the NW. ¼ Sec. 31, Tp. 8, Rge. 3, W. 4th Mer., about one-quarter mile down stream from dam.

Records available.—None.

Gauge.—Vertical staff driven into the bed of the ditch near the left bank; zero elevation maintained at 95.93 feet since establishment.

Bench-mark.—Permanent iron bench-mark located on the left bank four feet from the gauge; assumed elevation 100.00 feet.

Channel.—Composed of gravel loam.
Discharge measurements.—Made with current-meter or weir.
Observer.—L. C. Brown.
Remarks.—It is understood that no water was diverted during 1916.

ROSS CREEK AT IRVINE

Location.—On NW. ¼ Sec. 31, Tp. 11, Rge. 2, W. 4th Mer., at traffic bridge in town of Irvine, and about four hundred yards below the Canadian Pacific Railway Company's dam.
Records available.—July 29, 1909, to November 4, 1916.
Gauge.—Staff: the elevation of the zero of the gauge, 2,477.79 feet, has been unchanged since establishment.
Bench-mark.—Permanent iron bench-mark: elevation 2,500.43 feet above mean sea-level (Geodetic survey).
Channel.—Shifting.
Discharge measurements.—From traffic bridge by wading or with weir.
Winter flow.—Observations discontinued during winter.
Diversions.—Canadian Pacific Railway Company pump water from creek above dam for their water tank at Irvine.
Observer.—Observations were made by H. E. Price from February 15 to July 19, and by N. J. Corbett from July 19 to November 4, in 1916.

DISCHARGE MEASUREMENTS of Ross creek at Irvine, for 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 4	E. J. Switzer	13.8	11.18	1.21	1.42	13.6
April 19	do	13.4	9.46	1.17	1.30	11.1
May 19	do	12.0	5.11	0.58	0.89	3.0
May 27	do	31.5	85.69	1.54	4.31	132.0
June 12	R. J. McGuinness	.....	.....	.....	7.54	492.0*w*
June 15	do	28.2	71.07	1.59	3.70	113.0
June 21	E. J. Switzer	24.8	33.19	0.98	2.23	33.0
June 29	do	25.5	42.20	1.19	2.57	50.0
July 18	do	25.6	39.22	1.02	2.26	42.0
July 18	do	25.0	18.64	2.08	2.29	39.0
July 24	do	16.3	14.37	0.92	1.35	13.2
Aug. 18	do	16.5	13.64	1.21	1.31	17.0
Aug. 22	do	13.0	8.59	1.16	1.10	10.0
Sept. 26	do	12.7	6.62	0.51	0.83	3.4
Nov. 2	do	13.0	6.50	1.18	0.95	7.7

w Discharge determined by using 50-feet crest of C.P.R. dam as a weir.

DAILY GAUGE HEIGHT AND DISCHARGE of Ross creek at Irvine, for 1916

DAY	February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			1.56	18.1	1.68	21.0	1.16	9.4	4.11	127.0
2			1.51	16.9	1.66	20.0	1.16	9.4	4.14	129.0
3			1.46	15.7	1.46	15.7	1.16	9.4	4.39	146.0
4			1.41	14.6	1.42	14.8	1.16	9.4	4.34	142.0
5			1.36	13.5	1.41	14.6	1.16	9.4	5.14	206.0
6			1.26	11.4	1.36	13.5	1.16	9.4	5.12	204.0
7			1.34	13.1	1.32	12.6	1.14	9.0	5.11	203.0
8			2.26	38.0	1.26	11.4	1.12	8.6	5.10	202.0
9			3.46	90.0	1.26	11.4	1.05	7.2	6.22	324.0
10			6.06	304.0	1.26	11.4	1.03	6.8	8.16	572.0
11			9.56	751.0	1.27	11.6	1.03	6.8	8.31	591.0
12			7.69	512.0	1.27	11.6	1.03	6.8	7.54	493.0
13			5.09	202.0	1.27	11.6	1.03	6.8	6.12	312.0
14			4.26	137.0	1.27	11.6	1.05	7.2	5.06	199.0
15	1.06	5.0e	3.91	115.0	1.27	11.6	1.03	6.8	3.70	103.0
16	2.06	20.0	3.16	76.0	1.25	11.2	1.01	6.4	3.12	74.0
17	10.06	75.0	2.31	40.0	1.23	10.8	0.99	6.0	3.04	70.0
18	9.26	200.0e	2.26	38.0	1.25	11.2	0.92	4.8	2.09	33.0
19	6.96	418.0	2.46	45.0	1.30	12.2	0.89	4.2	2.04	31.0
20	5.07	200.0	2.46	45.0	1.27	11.6	0.89	4.2	1.14	9.0
21	4.56	158.0	1.66	20.0	1.26	11.4	0.88	4.0	2.23	37.0
22	4.08	125.0	2.56	49.0	1.25	11.2	0.94	5.1	1.11	8.4
23	3.09	72.0	2.46	45.0	1.24	11.0	0.99	6.0	3.10	73.0
24	2.53	48.0	2.11	33.0	1.22	10.6	1.89	27.0	3.12	74.0
25	2.09	33.0	1.56	18.1	1.19	10.0	2.24	38.0	3.14	75.0
26	1.91	27.0	1.98	29.0	1.13	8.8	3.50	92.0	3.74	105.0
27	1.38	13.9	2.46	45.0	1.08	7.8	4.31	140.0	3.64	100.0
28	1.66	20.0	2.36	42.0	1.01	6.4	5.04	197.0	3.69	102.0
29	1.61	19.3	2.07	32.0	1.04	7.0	5.07	200.0	2.57	50.0
30			1.66	20.0	1.07	7.6	5.10	202.0	4.74	172.0
31			1.68	21.0			4.13	128.0		

e-ε Discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of Ross creek at Irvine, for 1916.—*Concluded.*

DAY	July		August		September		October		November	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.84	180.0	1.10	8.2	0.88	4.0	0.89	4.2	0.98	5.8
2	5.04	197.0	2.00	30.0	0.88	4.0	0.91	4.6	0.95	5.3
3	5.94	290.0	1.02	6.6	.....	5.1*e*	0.96	5.5	0.96	5.5
4	7.64	505.0	0.99	6.0	1.00	6.2	1.04	7.0	0.96	5.5
5	7.24	454.0	0.94	5.1	1.21	10.4	1.17	9.6	.....	.....
6	3.14	75.0	0.97	5.7	1.35	13.3	1.22	10.6	.....	.....
7	2.14	34.0	0.88	4.0	1.41	14.6	1.28	11.8	.....	.....
8	4.84	180.0	0.79	2.4	1.26	11.4	1.24	11.0	.....	.....
9	6.04	302.0	1.72	22.0	1.15	9.2	1.20	10.2	.....	.....
10	4.54	156.0	5.93	289.0	1.08	7.8	1.17	9.6	.....	.....
11	3.64	100.0	3.20	77.0	1.00	6.2	1.16	9.4	.....	.....
12	3.44	89.0	2.30	40.0	0.96	5.5	1.13	8.8	.....	.....
13	2.24	38.0	1.74	23.0	0.96	5.5	1.09	8.0	.....	.....
14	1.74	23.0	1.56	18.1	0.96	5.5	1.06	7.4	.....	.....
15	1.34	13.1	1.34	13.1	0.94	5.1	1.05	7.2	.....	.....
16	1.24	11.0	1.22	10.6	0.92	4.8	1.05	7.2	.....	.....
17	1.44	15.3	1.18	9.8	0.90	4.4	1.04	7.0	.....	.....
18	2.26	38.0	1.31	12.4	0.88	4.0	1.04	7.0	.....	.....
19	1.92	28.0	1.32	12.6	0.87	3.9	1.02	6.6	.....	.....
20	1.88	26.0	1.27	11.6	0.84	3.3	1.03	6.8	.....	.....
21	1.66	20.0	1.19	10.0	0.82	3.0	1.02	6.6	.....	.....
22	1.52	17.2	1.10	8.2	0.79	2.4	1.01	6.4	.....	.....
23	1.41	14.6	1.02	6.6	0.78	2.3	1.02	6.6	.....	.....
24	1.35	13.3	0.98	5.8	0.77	2.1	1.04	7.0	.....	.....
25	1.29	12.0	0.96	5.5	0.77	2.1	1.01	6.4	.....	.....
26	1.69	21.0	0.98	5.8	0.83	3.1	1.00	6.2	.....	.....
27	1.59	18.9	1.00	6.2	0.84	3.3	1.02	6.6	.....	.....
28	1.46	15.7	0.97	5.7	0.84	3.3	1.06	7.4	.....	.....
29	1.43	15.0	0.92	4.8	0.89	4.2	1.05	7.2	.....	.....
30	1.30	12.2	0.90	4.4	0.90	4.4	1.05	7.2	.....	.....
31	1.24	11.0	0.89	4.2	.....	.....	1.03	6.8	.....	.....

e Discharge estimated.

MONTHLY DISCHARGE of Ross creek at Irvine, for 1916

(Drainage area 248 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
February (15-29)	418.0	5.0	96.0	0.387	0.22	2,856
March	751.0	11.4	92.0	0.371	0.43	5,657
April	21.0	6.4	11.8	0.048	0.05	702
May	202.0	4.0	38.0	0.153	0.18	2,337
June	591.0	8.4	166.0	0.669	0.75	9,878
July	505.0	11.0	94.0	0.379	0.44	5,780
August	289.0	2.4	22.0	0.089	0.10	1,353
September	14.6	2.1	5.5	0.022	0.02	327
October	11.8	4.2	7.5	0.030	0.03	461
November (1-4)	5.8	5.3	5.5	0.022	0.00	44
The period	.....	.....	.....	.....	2.22	29,395

MEAN MONTHLY DISCHARGE in Second-feet of Ross creek at Irvine

MONTH	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	1.52	0.02	9.90	0.84	7.5	4.0	243
November	.....	0.46*b*	.....	.....	.....	5.5*e*	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	96.00*d*	.....	.....	.....
March	.....	.....	28.00	121.00*c*	92.00	.....	60.0	3,690
April	94.00*a*	72.00	42.00	46.00	11.80	.....	43.0	2,558
May	23.00	12.50	7.20	16.40	38.00	.....	19.4	1,196
June	9.50	1.25	0.13	52.00	166.00	.....	46.0	2,724
July	0.43	1.92	Nil	18.70	94.00	.....	23.0	1,415
August	3.60	0.52	"	11.90	22.00	.....	760.0	468
September	7.50	0.02	"	0.38	5.50	.....	2.7	159
Total in Acre-feet	7,733	5,397	4,672	14,392	28,942	.....	.....	12,453

a 4-30.
b 1-16.
c 11-31.
d 15-29.
e 1-4.

J. K. DRINNAN'S MAIN SOUTH DITCH FROM ROSS CREEK

Location.—On the NE. ¼ Sec. 7, Tp. 12, Rge. 3, W. 4th Mer., about 1,130 feet below intake of ditch.

Records available.—For irrigation season of 1916.

Gauge.—Vertical staff fastened to a post driven into bed of ditch at left bank; assumed elevation of zero of gauge 96.12 feet.

Bench-mark.—Permanent iron bench-mark, located on left bank of creek, twenty feet down stream from dam and ninety feet back from creek; assumed elevation 100.00 feet.

Channel.—Ditch is composed of sandy loam.

Discharge measurements.—Made by wading with current-meter or with weir.

Observer.—J. K. Drinnan.

DISCHARGE MEASUREMENTS of J. K. Drinnan's Main South ditch from Ross creek, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
May 19	E. J. Switzer	9.5	6.15	0.74	1.28	4.60
May 19	do	9.2	5.70	0.68	1.24	3.90
May 19	do	8.9	5.38	0.68	1.19	3.70
May 19	do	8.2	3.86	0.28	0.95	1.09

DAILY GAUGE HEIGHT AND DISCHARGE of J. K. Drinnan's Main South ditch from Ross creek, for 1916

APRIL			MAY			MAY			MAY		
Day	Gauge Height	Discharge	Day	Gauge Height	Discharge	Day	Gauge Height	Discharge	Day	Gauge Height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*
23	1.53	7.90	1	0.83	0.63	8	0.78	0.50	15	0.53	0.19
24	1.38	5.90	2	0.83	0.63	9	0.83	0.63	16	0.33	0.07
25	0.63	0.27	3	0.83	0.63	10	0.88	0.79	17	0.38	0.09
26	0.63	0.27	4	0.78	0.50	11	0.68	0.33	18	0.73	0.41
27	0.78	0.50	5	0.88	0.79	12	0.58	0.23	19	0.99	1.35
28	.....	2.10*e*	6	0.88	0.79	13	0.53	0.19	20	0.31	0.06
29	1.38	5.90	7	0.88	0.79	14	0.53	0.19	.....	.....	.....
30	0.83	0.63	.....	.....	.....	.....	.....	.....	.....	.....	.....

e Discharge estimated.

MONTHLY DISCHARGE of J. K. Drinnan's Main South ditch from Ross creek, for 1916

MONTH	DISCHARGE IN SECOND-FEET			Total Discharge in Acre-ft.
	Maximum	Minimum	Mean	
April (23-30)	7.90	0.27	2.90	46
May 1-20)	1.35	0.06	0.49	19
The period				65

J. K. DRINNAN'S MAIN NORTH DITCH FROM ROSS CREEK

Location.—On the NE. ¼ Sec. 7, Tp. 12, Rge. 3, W. 4th Mer., 300 feet below intake of ditch and about one mile east of Pashley P.O.

Records available.—From April 28 to May 13, 1916.

Gauge.—Vertical staff fastened to a post driven in bed of ditch at left bank elevation of zero of gauge 95.68 feet.

Bench-mark.—Permanent iron bench-mark, located on left bank of creek, twenty feet down stream from dam and ninety feet back from creek; assumed elevation 100.00 feet.

Channel.—Ditch is composed of sandy loam.

Discharge measurements.—Made by wading with current-meter or with weir.

Observer.—J. K. Drinnan.

DISCHARGE MEASUREMENTS of J. K. Drinnan's Main North ditch from Ross creek, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
May 19	E. J. Switzer	8.9	4.12	0.17	1.60	0.69
May 20	do				1.38	0.52*w*
May 20	do				1.33	0.36*w*

w Discharge determined by using an 18-inch weir.

DAILY GAUGE HEIGHT AND DISCHARGE of J. K. Drinnan's Main North ditch from Ross creek, for 1916

APRIL			MAY			MAY			MAY		
Day	Gauge Height	Discharge	Day	Gauge Height	Discharge	Day	Gauge Height	Discharge	Day	Gauge Height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*
28	2.24*h*	2.3	1	2.09	2.10	8	2.09	2.10	15	1.09	0.15
29		2.5*e*	2	2.14	2.30	9	2.24	2.60	16	0.59	0.01
30	2.19	2.4	3	2.24	2.60	10	2.09	2.10	17	0.69	0.02
			4	2.09	2.10	11	1.89	1.53	18	0.79	0.03
			5	2.14	2.30	12	1.24	0.27	19	0.88*h*	0.05
			6	2.04	1.98	13	1.19	0.22			
			7	2.04	1.98	14	1.15	0.19			

e Discharge estimated.
h Headgate opened on April 28 and closed on May 19.

MONTHLY DISCHARGE of J. K. Drinnan's Main North ditch from Ross creek, for 1916

MONTH	DISCHARGE IN SECOND-FEET			Total Discharge in Acre-ft.
	Maximum	Minimum	Mean	
April (28-30)	2.50	2.30	2.40	14
May (1-19)	2.60	0.01	1.30	49
The period				63

J. K. DRINNAN'S NORTH LATERAL DITCH FROM ROSS CREEK

Location.—On the NE. ¼ Sec. 7, Tp. 12, Rge. 3, W. 4th Mer., located 40 feet below head of lateral ditch and about one mile east of Pashley P.O.

Records available.—Gauge heights taken from May 13 to May 19, 1916. No discharge measurements during 1916.

Gauge.—Vertical staff located at right bank of ditch; zero elevation 97.49 feet.

Bench-mark.—Permanent iron bench-mark located on left bank of creek, twenty feet down stream from dam and ninety feet back from creek; assumed elevation 100.00 feet.

Channel.—Composed of sandy loam.

Observer.—J. K. Drinnan.

Remarks.—Water used for irrigation purposes for seven days, May 13 to May 19; estimated average discharge, 1.5 second-feet.

J. K. DRINNAN'S SOUTH LATERAL DITCH FROM ROSS CREEK

Location.—On the NE. ¼ Sec. 7, Tp. 12, Rge. 3, W. 4th Mer., located 65 feet below head of lateral ditch and about three-quarters of a mile east of Pashley P.O.

Records available.—Gauge heights taken from April 23 to April 29, 1916; no discharge measurements in 1916.

Gauge.—Vertical staff located at left bank of creek; zero elevation 96.77 feet.

Bench-mark.—Permanent iron bench-mark situated on left bank, twenty feet down stream from dam and ninety feet back from creek; assumed elevation 100.00 feet.

Channel.—Composed of sandy loam.

Observer.—J. K. Drinnan.

Remarks.—Water used for irrigation purposes for seven days, April 23 to April 29; estimated average discharge 0.75 second-feet.

BULLSHEAD CREEK AT JOHNSTON'S RANCH

Location.—On the SW. ¼ Sec. 4, Tp. 11, Rge. 5, W. 4th Mer., at J. A. Johnston's ranch, Woolchester, Alberta. This station was established May 15, 1915, and the former station at Clark's ranch was discontinued May 16, 1915.

Records available.—May 15, 1915, to October 31, 1916.

Gauge.—Vertical staff. The zero has been maintained at 94.31 feet.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—Practically permanent.

Winter flow.—Station discontinued during winter season.

Observer.—J. A. Johnston.

DISCHARGE MEASUREMENTS of Bullshead creek at Johnston's ranch, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 13	F. J. Switzer	22.8	10.44	0.60	1.42	6.3
May 26	do	59.5	59.68	0.78	1.86	47.0
June 28	do	50.0	41.41	0.24	1.48	10.0
July 19	do	24.7	12.06	0.53	1.40	6.4
Aug. 21	do	18.9	9.22	0.38	1.32	3.0

DAILY GAUGE HEIGHT AND DISCHARGE of Bullshead creek at Johnston's ranch, for 1916

DAY	February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			1.29*b*	5.0	1.69	28.0	1.25	1.60	1.57	16.8
2			1.21	4.0	1.62	21.0	1.25	1.60	1.57	16.8
3			1.19	3.0	1.58	17.6	1.25	1.60	1.63	22.0
4			1.17	2.0	1.52	12.9	1.25	1.60	1.78	37.0
5			1.17	1.0	1.46	8.9	1.24	1.44	1.79	38.0
6			.....*x*	Nil	1.47	9.6	1.24	1.44	1.89	51.0
7			.....	"	1.47	9.6	1.24	1.44	1.97	61.0
8			.....	"	1.47	9.6	1.24	1.44	1.87	48.0
9			.....	"	1.48	10.2	1.24	1.44	1.86	47.0
10			.....*x*	"	1.49	10.9	1.24	1.44	2.14	84.0
11			1.81	40.0	1.49	10.9	1.23	1.28	3.04	210.0
12	1.49*b*	10.0	2.45*b*	100.0	1.49	10.9	1.22	1.12	2.98	201.0
13	1.56	15.0	2.44	126.0	1.42	6.8	1.22	1.12	2.79	175.0
14	1.61*b*	20.0	2.97	200.0	1.42	6.8	1.22	1.12	1.93	56.0
15	1.72	30.0	2.77	172.0	1.38	5.1	1.22	1.12	1.71	30.0
16	2.30	106.0	2.69	161.0	1.38	5.1	1.19	0.74	1.56	16.0
17	3.09	217.0	2.21	94.0	1.38	5.1	1.19	0.74	1.29	2.4
18	3.02	207.0	1.91	53.0	1.37	4.7	1.19	0.74	1.49	10.9
19	2.80	176.0	1.69	28.0	1.36	4.4	1.16	0.56	1.46	8.9
20	2.21	94.0	1.72	31.0	1.32	3.2	1.16	0.56	1.42	6.8
21	1.92	54.0	1.74	33.0	1.32	3.2	1.15	0.50	1.36	4.4
22	2.08	76.0	1.80	40.0	1.32	3.2	1.14	0.46	1.36	4.4
23	2.07	74.0	1.94	57.0	1.29	2.4	1.18	0.68	1.48	10.2
24	1.99	63.0	1.87	48.0	1.29	2.4	1.42	6.80	1.50	11.5
25	1.81	41.0	1.76	35.0	1.29	2.4	1.61	20.00	1.45	8.3
26	1.75	34.0	1.75	34.0	1.29	2.4	1.86	47.00	1.44	7.8
27	1.63	22.0	1.75	34.0	1.27	2.0	2.01	66.00	1.41	6.3
28	1.54	14.4	1.73	32.0	1.27	2.0	1.69	28.00	1.48	10.2
29	1.50	11.5	1.73	32.0	1.27	2.0	1.66	25.00	1.43	7.3
30			1.73	32.0	1.27	2.0	1.61	20.00	1.77	36.0
31			1.69	28.0			1.61	20.00		

b Ice conditions, Feb. 12 to 14 and Mar. 1 to 12; discharge estimated.
x-x Creek frozen solid.

DAILY GAUGE HEIGHT AND DISCHARGE of Bullshead creek at Johnston's ranch, for 1916
—*Concluded*

Day	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.66	25.00	1.33	3.40	1.19	0.74	1.16	0.56
2	1.65	24.00	1.27	2.00	1.18	0.68	1.24	1.44
3	2.03	69.00	1.17	0.62	1.42	6.80	1.29	2.40
4	2.38	117.00	1.16	0.56	1.66	25.00	1.23	1.28
5	1.87	48.00	1.16	0.56	1.65	24.00	1.27	2.00
6	1.63	22.00	1.13	0.42	1.51	12.20	1.35	4.00
7	1.63	22.00	1.08	0.26	1.43	7.30	1.35	4.00
8	1.85	46.00	1.02	0.14	1.43	7.30	1.33	3.40
9	1.98	62.00	0.96	Nil	1.42	6.80	1.33	3.40
10	1.89	51.00	0.96	"	1.37	4.70	1.28	2.20
11	1.84	44.00	1.09	0.28	1.37	4.70	1.27	2.00
12	1.77	36.00	2.62	151.00	1.36	4.40	1.27	2.00
13	1.56	16.00	2.43	124.00	1.39	5.40	1.27	2.00
14	1.41	6.30	1.98	62.00	1.32	3.20	1.27	2.00
15	1.37	4.70	1.86	47.00	1.27	2.00	1.27	2.00
16	1.29	2.40	1.86	47.00	1.25	1.60	1.27	2.00
17	1.26	1.80	1.79	39.00	1.24	1.44	1.26	1.80
18	1.35	4.00	1.90	52.00	1.20	0.80	1.28	2.20
19	1.40	5.80	1.89	51.00	1.20	0.80	1.27	2.00
20	1.35	4.00	1.49	10.90	1.20	0.80	1.27	2.00
21	1.35	4.00	1.32	3.20	1.19	0.74	1.26	1.80
22	1.29	2.40	1.46	8.90	1.19	0.74	1.27	2.00
23	1.28	2.20	1.46	8.90	1.16	0.56	1.26	1.80
24	1.25	1.60	1.41	6.30	1.12	0.38	1.26	1.80
25	1.23	1.28	1.33	3.40	1.17	0.62	1.29	2.40
26	1.23	1.28	1.32	3.20	1.16	0.56	1.29	2.40
27	1.25	1.60	1.32	3.20	1.16	0.56	1.28	2.20
28	1.45	8.30	1.30	2.60	1.16	0.56	1.28	2.20
29	1.42	6.80	1.24	1.44	1.16	0.56	1.27	2.00
30	1.40	5.80	1.19	0.74	1.16	0.56	1.27	2.00
31	1.35	4.00	1.19	0.74	.....	.....	1.27	2.00

MONTHLY DISCHARGE of Bullshead creek at Johnston's ranch, for 1916

(Drainage area 134 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
February (12-29)	217.0	10.00	70.0	0.522	0.35	2,499
March	200.0	0.00	46.0	0.343	0.40	2,828
April	28.0	2.00	7.5	0.056	0.06	446
May	66.0	0.46	8.3	0.062	0.07	510
June	210.0	2.40	42.0	0.313	0.35	2,499
July	117.0	1.28	21.0	0.157	0.18	1,291
August	151.0	0.00	20.0	0.149	0.17	1,230
September	25.0	0.38	4.2	0.031	0.03	250
October	4.0	0.56	2.2	0.016	0.02	135
The period	.....	.....	.....	.....	1.63	11,688

STARK AND BURTON DITCH FROM BULLSHEAD CREEK

Location.—On the SE. ¼ Sec. 17, Tp. 11, Rge. 5, W. 4th Mer., at Stark and Burton's ranch, near Medicine Hat.

Records available.—Estimates are available for the years of 1912-14, complete records for 1915-16.

Gauge.—Vertical staff; the zero of the gauge has been maintained at 94.58 feet since establishment.

Bench-mark.—Permanent iron bench-mark established twenty-nine feet SW. from gauge; assumed elevation 100.00 feet.

Channel.—Composed of sand and gravel.

Discharge measurements.—Made with a current-meter by wading.

Control.—On September 14, 1915, a permanent seven-foot sharp crested rectangular weir was installed twenty-five feet below the gauge. The elevation of the crest is maintained at 95.39 feet.

Observer.—R. E. Stark.

DISCHARGE MEASUREMENTS of Stark and Burton ditch from Bullshead creek, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 17	E. J. Switzer	9.5	3.55	1.09	1.08	3.90
April 17	do	9.0	2.65	0.89	0.99	2.40
April 17	do				0.89	1.65*w*
April 17	do				0.69	0.44*w*
May 26	do	8.9	2.97	0.88	1.02	2.60
Aug. 21	do	9.0	3.20	0.90	1.06	2.90

w Discharge measured with 18-inch weir.

DAILY GAUGE HEIGHT AND DISCHARGE of Stark and Burton ditch from Bullshead creek, for 1916

Day	March		April		May		June		July		August	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			0.85	1.37	0.95	2.10						
2			0.85	1.37	0.95	2.10						
3			1.05	3.00	0.84	1.31						
4			1.05	3.00	0.74	0.69						
5			0.95	2.10	0.74	0.69						
6			1.05	3.00	0.74	0.69						
7			1.05	3.00	0.74	0.69						
8			1.35	8.60	0.74	0.69						
9			1.35	8.60	0.74	0.64						
10			1.35	8.60	0.74	0.64						
11			1.15	4.60	0.68	0.40						
12			1.05	3.00	0.68	0.40						
13			1.25	6.50	0.68	0.40						
14			1.25	6.50	0.74	0.69						
15			1.25	6.50		0.69*e*			1.04*h*	2.90		
16			1.05	3.00		0.69*e*			1.04	2.90		
17			1.05	3.00	0.74	0.69			1.04	2.90		
18			1.05	3.00	0.74	0.69			1.04*h*	2.90		
19			0.95	2.10	0.73	0.64						2.9*e*
20			0.95	2.10	0.63	0.18						3.0*e*
21			0.95	2.10		0.31*e*					1.06	3.2
22			0.95	2.10		0.49*e*						2.9*e*
23			0.95	2.10	0.73	0.64						
24			0.95	2.10	0.83	1.24						
25			0.85	1.37	0.93*h*	1.94						
26			0.75	0.74	0.92	1.86						
27			0.75	0.74								
28			0.75	0.74								
29	0.85*h*	1.37	0.75	0.74								
30	0.95	2.10	1.05	3.00								
31	0.85	1.37										

e Discharge estimated.
h Headgate opened Mar. 29, closed May 25; opened July 15, closed July 18.

MONTHLY DISCHARGE of Stark and Burton ditch from Bullshead creek, for 1916

MONTH	DISCHARGE IN SECOND-FEET			RUN-OFF
	Maximum	Minimum	Mean	Total Discharge in acre-ft.
March (29-31)	2.10	1.37	1.61	10
April	8.60	0.74	3.30	196
May (1-26)	2.10	0.18	0.85	44
June				
July (15-18)	2.90	2.90	2.90	23
August (19-22)	3.20	2.90	3.00	24
The period				297

BULLSHEAD CREEK NEAR DUNMORE

Location.—On SE. ¼ Sec. 16, Tp. 12, Rge. 5, W. 4th Mer., at the traffic bridge about four miles east of Medicine Hat, and about one mile above the junction of Ross and Bullshead creeks.

Records available.—July 26, 1909, to October 31, 1916.

Gauge.—Staff. Zero elevation of gauge, 2,295.65 during 1909-11; zero elevation of gauge 2,295.01 during 1912; zero elevation of gauge 2,295.06 during 1913-16.

Bench-mark.—Permanent iron bench-mark; elevation 2,305.53 above mean sea-level (Geodetic Survey).

Channel.—Shifting.

Discharge measurements.—From bridge, or by wading with meter; or with a weir.

Winter flow.—Station not maintained during the winter.

Remarks.—It has been impossible to secure an observer at reasonable cost and daily observations have not, therefore, been secured during 1914-15-16.

DISCHARGE MEASUREMENTS of Bullshead creek near Dunmore, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 12	E. J. Switzer	8.3	2.11	0.68	1.31	1.44
May 26	do	29.4	19.38	1.62	2.00	31.00
June 15	R. J. McGuinness	28.0	35.55	0.86	1.95	31.00
June 26	E. J. Switzer	10.2	6.28	1.57	1.55	9.90
July 24	do	9.0	3.12	0.84	1.25	2.60
Aug. 21	do	7.9	2.32	0.52	1.14	1.20

SEVENPERSONS RIVER DRAINAGE BASIN

General Description

Seven persons river lies between the South Saskatchewan river and the Cypress hills and empties into the South Saskatchewan river at Medicine Hat. The drainage area consists mostly of open level prairie which has a small rainfall and a run-off confined chiefly to the spring freshet.

The creek has a considerable flow during the month of April, but the discharge decreases to nil about June.

There are no irrigation works of importance on this stream and the records are valuable chiefly for statistical purposes.

SEVENPERSONS RIVER AT MEDICINE HAT

Location.—On NE. ¼ Sec. 30, Tp. 12, Rge. 5, W. 4th Mer., at the bridge on the road between Medicine Hat and Dunmore and about one and one-half miles east of the Canadian Pacific Railway station at Medicine Hat.

Records available.—April 27, 1910, to October 11, 1916.

Gauge.—Vertical staff; elevation of zero maintained at 86.68 feet since establishment.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—Shifting.

Discharge measurements.—From bridge, by wading or with a weir.

Winter flow.—Observations discontinued during the winter.

Observer.—A. Hooper.

DISCHARGE MEASUREMENTS of Sevenpersons river at Medicine Hat, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
April 12	E. J. Switzer	24.0	9.26	0.39	1.86	3.60
May 24	do	4.6	1.13	0.43	1.63	0.49
June 15	R. J. McGuinness	47.0	87.10	2.30	3.13	200.00
June 26	E. J. Switzer	38.3	27.25	0.70	2.10	19.20
July 22	do	28.4	11.38	0.84	1.93	9.50
Aug. 21	do	15.6	11.30	0.52	1.84	6.00
Oct. 30	do	6.0	0.67	0.52	1.70	0.35

DAILY GAUGE HEIGHT AND DISCHARGE of Sevenpersons river at Medicine Hat, for 1916

Day	February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1				280.0	2.22	28.0	1.74	3.00	2.05	16.1
2				290.0	2.20	26.0	1.74	3.00	2.10	19.2
3				300.0	2.20	26.0	1.73	2.70	2.16	23.0
4				350.0	2.16	23.0	1.72	2.50	2.38	43.0
5			4.45	485.0	2.10	19.2	1.72	2.50	2.34	39.0
6			4.45	485.0	2.05	16.1	1.70	1.90	2.30	35.0
7			4.45	485.0	1.98	12.3	1.74	3.00	2.27	32.0
8			4.45	485.0	1.98	12.3	1.73	2.70	2.25	30.0
9			4.43	480.0	1.97	11.8	1.72	2.50	2.24	29.0
10			4.38	470.0	1.95	10.8	1.73	2.70	2.24	29.0
11			4.19	450.0	1.95	10.8	1.74	3.00	2.24	29.0
12			3.77*b*	400.0	1.86	7.0	1.74	3.00	2.90	138.0
13			5.17	750.0	1.93	9.9	1.72	2.50	3.10	192.0
14			4.50	570.0	1.92	9.5	1.72	2.50	3.40	272.0
15			4.11	464.0	1.92	9.5	1.72	2.50	3.13	200.0
16			3.53	308.0	1.90	8.6	1.72	2.50	3.44	283.0
17			3.50	300.0	1.88	7.8	1.72	2.50	3.46	289.0
18			2.80	112.0	1.86	7.0	1.72	2.50	3.10	192.0
19			2.66	82.0	1.85	6.6	1.72	2.50	2.96	154.0
20			2.66	82.0	1.83	5.9	1.73	2.70	2.80	112.0
21			2.75	100.0	1.82	5.6	1.70	1.90	2.40	45.0
22	3.70	354	2.80	112.0	1.80	4.9	1.68	1.38	2.26	31.0
23	3.70	354	3.11	194.0	1.80	4.9	1.65	0.60	2.18	25.0
24	3.14	202	3.05	178.0	1.78	4.2	1.63	0.36	2.13	21.0
25	3.14	202	2.50	57.0	1.77	3.9	1.63	0.36	2.15	22.0
26	3.53	308	2.40	45.0	1.75	3.3	1.62	0.24	2.10	19.2
27	3.54	310	2.35	40.0	1.74	3.0	1.62	0.24	2.30	35.0
28	.....*b*	270	2.30	35.0	1.74	3.0	1.86	7.00	2.38	43.0
29	.....	270	2.25	30.0	1.74	3.0	1.90	8.60	2.40	45.0
30	.....	.....	2.11	19.9	1.73	2.7	1.96	11.30	2.42	47.0
31	.....	.....	2.15	22.0	.....	.....	1.99	12.80	.....	.....

b-b Ice conditions; discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of Sevenpersons river at Medicine Hat, for 1916—*Concluded*

Day	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.44	49.0	1.86	7.0	1.79	4.6	1.77	3.90
2	2.44	49.0	1.85	6.6	1.77	3.9	1.79	4.60
3	2.60	71.0	1.83	5.9	1.79	4.6	1.80	4.90
4	3.50	300.0	1.82	5.6	1.81	5.2	1.82	5.60
5	3.40	272.0	1.80	4.9	1.83	5.9	1.83	5.90
6	3.63	335.0	1.90	8.6	1.84	6.3	1.85	6.60
7	3.65	340.0	2.10	19.2	1.85	6.6	1.88	7.80
8	3.75	368.0	2.50	57.0	1.86	7.0	1.88	7.80
9	3.19	216.0	2.76	103.0	1.87	7.4	1.87	7.40
10	2.77	105.0	2.80	112.0	1.88	7.8	1.87	7.40
11	2.50	57.0	2.82	117.0	1.87	7.4	1.86	7.00
12	2.40	45.0	2.84	122.0	1.85	6.6	1.86	7.00
13	2.22	28.0	2.75	100.0	1.82	5.6	1.85	6.60
14	2.18	25.0	2.60	71.0	1.80	4.9	1.84	6.30
15	2.11	19.9	2.50	57.0	1.77	3.9	1.83	5.90
16	2.11	19.9	2.38	43.0	1.75	3.3	1.82	5.60
17	2.10	19.2	2.30	35.0	1.74	3.0	1.80	4.90
18	2.10	19.2	2.15	22.0	1.74	3.0	1.79	4.60
19	2.09	18.6	2.00	13.3	1.75	3.3	1.78	4.20
20	2.09	18.6	1.98	12.3	1.76	3.6	1.77	3.90
21	2.08	17.9	1.84	6.3	1.76	3.6	1.77	3.90
22	1.93	9.9	1.91	9.0	1.77	3.9	1.76	3.60
23	2.01	13.9	1.90	8.6	1.77	3.9	1.76	3.60
24	1.98	12.3	1.89	8.2	1.77	3.9	1.77	3.90
25	1.96	11.3	1.88	7.8	1.77	3.9	1.77	3.90
26	1.94	10.4	1.85	6.6	1.77	3.9	1.78	4.20
27	1.93	9.9	1.88	7.8	1.78	4.2	1.78	4.20
28	1.92	9.5	1.86	7.0	1.78	4.2	1.78	4.20
29	1.90	8.6	1.84	6.3	1.78	4.2	1.77	3.90
30	1.90	8.6	1.82	5.6	1.79	4.6	1.70	1.90
31	1.88	7.8	1.80	4.9	.....	.....	1.75	3.30

MONTHLY DISCHARGE of Sevenpersons river at Medicine Hat, for 1916

(Drainage area 797 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
February (22-29)	354.0	202.00	284.0	0.356	0.11	4,505
March	750.0	19.90	273.0	0.343	0.40	16,786
April	28.0	2.70	10.2	0.013	0.01	607
May	12.8	0.24	3.1	0.004	0.00	191
June	289.0	16.10	83.0	0.104	0.12	4,939
July	368.0	7.80	80.0	0.100	0.12	4,919
August	122.0	4.90	32.0	0.040	0.05	1,968
September	7.8	3.00	4.8	0.006	0.01	286
October	7.8	1.90	5.1	0.006	0.01	314
The period	.....	.....	.....	.....	0.83	34,515

LAKE JOHNSTON DRAINAGE BASIN

General Description

Lake Johnston lies about twenty miles southwest of the city of Moosejaw. It is about twenty-five miles long and fifteen miles wide, and covers an area of nearly five townships. Almost all the drainage into the lake comes from the south and west through Wood river. The main tributaries of Wood river are Wiwa creek, Notukeu creek, Pinto creek and Wood creek. These drain a large area, but owing to the limited rainfall and the small slope of the drainage basin the run-off is comparatively small.

Lake Johnston has no surface outlet and there has been no surface flow from lake Chaplin to lake Johnston for several years, but it will be noted that the elevations of the two lakes are the same. There is often considerable flow in Wood river in the spring, and there is always some discharge at all seasons; nevertheless, the water in the lake has, during recent years, receded.

The lower part of Wood river has a very small fall and is more of the nature of a long slough than that of a running stream. The channel is from twenty to fifty feet wide, and is from two to five feet deep. The bottom is composed of soft clay and is covered with weeds and grass. There is so little fall that it would be impossible to take out water by gravity and a dam would flood a large area of good agricultural land. There is, therefore, little possibility of irrigation development in this basin.

This drainage basin includes a large area of very good agricultural land. This is pretty well taken up by settlers and is being farmed with good results.

There is one irrigation scheme on Pearce creek, and the only regular gauging station in the drainage basin is on Notukeu creek.

NOTUKEU CREEK NEAR VANGUARD

Location.—On the NW. ¼ Sec. 10, Tp. 11, Rge. 10, W. 3rd Mer.

Records available.—August 6, 1914, to December 31, 1916.

Gauge.—Vertical staff, below a dam, one-quarter mile down stream from bridge. Zero elevation maintained at elevation 77.04 feet.

Bench-mark.—Permanent iron on right bank, thirty feet up stream from gauge; assumed elevation 85.07 feet.

Channel.—Above dam; gauge heights affected by changes in dam. Below dam, permanent.

Discharge measurements.—With current-meter by wading or from traffic bridge.

Observer.—Miss Constance Ripley.

DISCHARGE MEASUREMENTS of Notukeu creek near Vanguard, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 8	W. R. McCaffrey				*b*	*x*
Jan. 20	do				*b*	*x*
Feb. 17	H. W. Rowley				*b*	*x*
Mar. 7	do				*b*	*x*
Mar. 24	E. J. Switzer	105.0	778.33	2.06	13.85	1,602.0
April 8	do	41.0	114.30	1.43	3.28	164.0
May 6	do	37.7	53.48	0.71	1.42	38.0
June 12	do	38.4	60.61	0.86	1.64	53.0
July 4	do	61.0	242.55	2.04	6.81	495.0
Aug. 1	do	38.3	54.90	0.68	1.36	38.0
Aug. 12	do	38.0	43.13	0.44	1.07	19.0
Oct. 12	F. R. Shenstone	23.6	10.69	1.48	1.01	16.0
Nov. 7	do	19.0	6.75	1.75	0.92	11.9
Nov. 28	do	10.0	3.85	0.52	1.01*b*	2.0
Dec. 19	do	7.5	3.10	0.70	0.98*b*	2.2

b Ice conditions, Jan. 1 to Mar. 10 and Nov. 14 to Dec. 31.
x Creek frozen solid; no discharge, Jan. 1 to Mar. 10 and Dec. 24 to Dec. 31.

DAILY GAUGE HEIGHT AND DISCHARGE of Notukeu creek near Vanguard, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	0.30	Nil	Dry	Nil	Dry	Nil	....*b*	1,600	1.56	46	2.35	96
2	0.28	"	"	"	"	"	....*b*	1,000	1.47	41	2.27	90
3	0.26	"	"	"	"	"	6.53	462	1.47	41	2.18	84
4	0.26	"	"	"	"	"	5.04	310	1.53	44	2.02	74
5	0.25	"	"	"	"	"	4.70	279	1.47	41	1.87	64
6	0.25	"	"	"	"	"	4.18	236	1.42	38	1.74	56
7	0.23	"	"	"	"	"	3.83	207	1.36	35	1.64	51
8	0.23	"	"	"	"	"	3.31	166	1.32	33	1.60	48
9	0.23	"	"	"	"	"	3.45	177	1.30	32	1.54	45
10	0.23	"	"	"	"	" *x*	3.41	174	1.29	31	1.59	48
11	0.23	"	"	"	.....	10	3.51	182	1.26	30	1.60	48
12	0.21	"	"	"	.....	20	3.61	190	1.25	29	1.64	51
13	0.21	"	"	"	.....	40	3.69	196	1.25	29	1.59	48
14	0.21	"	"	"	.....	50	3.79	204	1.25	29	1.56	46
15	0.20	"	"	"	.....	60	3.94	216	1.25	29	1.52	44
16	0.17	"	"	"	.....	70	4.20	237	1.26	30	1.46	40
17	0.14	"	"	"	.....	80	4.20	237	1.28	31	1.41	38
18	0.10	"	"	"	.....	100	4.07	227	1.29	31	1.39	37
19	0.07	"	"	"	.....	150	3.99	220	1.31	32	1.35	34
20	0.03*x*	"	"	"	.....	300	3.86	210	1.31	32	1.32	33
21	Dry	"	"	"	.....	500	3.71	198	1.31	32	1.32	33
22	"	"	"	"	.....	800	3.50	181	1.33	33	1.32	33
23	"	"	"	"	.....*b*	1,300	3.34	169	1.34	34	1.33	33
24	"	"	"	"	.....	1,602*d*	3.14	153	1.39	37	1.34	34
25	"	"	"	"	.....*b*	1,692	2.46	103	1.47	41	1.34	34
26	"	"	"	"	.....	1,782	1.75	57	1.57	47	1.34	34
27	"	"	"	"	.....	1,872	1.70	54	1.67	52	1.34	34
28	"	"	"	"	.....	1,962	1.67	52	1.79	59	1.56	46
29	"	"	"	"	16.52	2,250	1.66	52	1.98	71	1.41	38
30	"	"	"	"	.....	1,900	1.61	49	2.16	83	4.53	265
31	"	"	"	"	.....	1,700	.....	.....	2.27	90	.....	.....

d Actual measurement.
b Ice conditions; discharge estimated, March 11 to 23; discharge estimated, March 25 to April 2.
x Jan. 1 to 20; gauge heights due to seepage through ice.
x-x Creek frozen solid.

DAILY GAUGE HEIGHT AND DISCHARGE of Notukeu creek near Vanguard, for 1916—*Concluded*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	4.32	247	1.36	35.0	1.15	24.0	1.03	18.0	1.01	17.0	0.99	2.00
2	5.11	316	1.35	34.0	1.13	23.0	1.03	18.0	1.01	17.0	0.99	2.00
3	6.07	412	1.33	33.0	1.10	22.0	1.03	18.0	1.01	17.0	0.99	2.00
4	6.81	495	1.33	33.0	1.12	23.0	1.02	17.5	1.01	17.0	0.99	2.00
5	.....	1,001*e*	1.27	30.0	1.11	22.0	1.02	17.5	1.01	17.0	0.99	2.00
6	9.06	798	1.25	29.0	1.10	22.0	1.03	18.0	1.01	17.0	0.99	2.00
7	7.41	568	1.23	28.0	1.08	20.0	1.04	18.5	0.92	12.6	0.99	2.00
8	6.36	444	1.22	28.0	1.10	22.0	1.04	18.5	1.01	17.0	0.99	2.00
9	8.74	750	1.22	28.0	1.11	22.0	1.02	17.5	1.01	17.0	0.97	1.90
10	8.71	745	1.17	25.0	1.07	20.0	1.02	17.5	1.01	17.0	0.97	1.90
11	7.01	519	1.13	23.0	1.05	19.0	1.03	18.0	1.01	17.0	0.97	1.90
12	5.57	361	1.07	20.0	1.03	18.0	1.01	17.0	1.01	17.0	0.97	1.90
13	4.19	236	1.10	22.0	1.03	18.0	1.03	18.0	1.01	17.0	0.97	1.90
14	3.24	161	1.10	22.0	1.02	17.5	1.03	18.0	1.00*b*	16.0	0.97	1.90
15	2.34	95	1.10	22.0	1.00	16.5	1.03	18.0	1.00	15.0	0.97	1.90
16	1.98	71	1.10	22.0	1.02	17.5	1.03	18.0	1.00	14.0	0.97	1.90
17	1.81	61	1.10	22.0	1.06	19.5	1.03	18.0	1.00	13.0	0.97	1.90
18	1.65	51	1.10	22.0	1.08	20.0	1.03	18.0	1.00	12.0	0.97	1.90
19	1.79	59	1.10	22.0	1.08	20.0	1.03	18.0	1.00	11.0	0.98	2.20
20	1.59	48	1.10	22.0	1.08	20.0	1.03	18.0	1.00	10.0	0.97	1.90
21	1.53	44	1.10	22.0	1.05	19.0	1.02	17.5	1.00	9.0	0.97	1.60
22	1.44	39	1.10	22.0	1.04	18.5	1.01	17.0	1.00	8.0	0.97	1.00
23	1.37	36	1.08	20.0	1.02	17.5	1.01	17.0	1.00	7.0	0.95	0.50
24	1.39	37	1.05	19.0	1.03	18.0	1.01	17.0	1.00	6.0	Dry	Nil *x*
25	1.35	34	1.07	20.0	1.07	20.0	1.01	17.0	1.00	5.0	"	" *x*
26	1.34	34	1.15	24.0	1.09	21.0	1.01	17.0	1.00	4.0	"	"
27	1.30	32	1.15	24.0	1.08	20.0	1.01	17.0	1.00	3.0	"	"
28	1.25	29	1.13	23.0	1.07	20.0	1.01	17.0	1.01	2.0	"	"
29	1.64	51	1.10	22.0	1.05	19.0	1.01	17.0	0.99	2.0	"	"
30	1.47	41	1.06	19.5	1.03	18.0	1.01	17.0	0.99	2.0	"	"
31	1.45	40	1.07	20.0	.....	.....	1.01	17.0	.....	.....	" *b*	" *x*

e Discharge estimated.
b-b Ice conditions; discharge estimated.
x-x Creek frozen solid; no discharge.

MONTHLY DISCHARGE of Notukeu creek near Vanguard, for 1916

(Drainage area 1,406 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January *x*	Nil	Nil	Nil	Nil	Nil	Nil
February	"	"	"	"	"	"
March *x*	2,250.0	10.0	588.00	0.418	0.48	36,155
April	1,600.0	49.0	260.00	0.185	0.21	15,471
May	90.0	29.0	41.00	0.029	0.03	2,521
June	265.0	33.0	55.00	0.039	0.04	3,273
July	1,001.0	29.0	253.00	0.180	0.21	15,556
August	35.0	19.0	24.00	0.017	0.02	1,476
September	24.0	16.5	19.00	0.014	0.02	1,184
October	18.5	17.0	17.60	0.013	0.02	1,082
November	17.0	2.0	11.90	0.008	0.01	708
December	2.2	0.0	1.36	0.001	0.00	84
The year	.....	.....	.....	.....	1.04	77,510

x Creek frozen solid; no discharge, Jan. 1 to Mar. 10.

QU'APPELLE RIVER DRAINAGE BASIN

General Description

Qu'Appelle river rises in Township 23, Range 4, West of the 3rd Meridian, and flows eastward into the Assiniboine river in Township 28, Range 17, West of the 1st Meridian. These waters eventually find their way into Hudson's bay through the Red river, lake Winnipeg and Nelson river.

The chief tributaries of Qu'Appelle river are Moosejaw creek, Last Mountain lake, Wascana creek and Loon creek. Last Mountain is the largest lake in the basin, being some sixty miles long and from one to three miles wide.

The valley of the main stream is from two to three hundred feet deep, with a flat from one to three miles wide along the river. This flat is covered in many places with brush and the side hills are in many places well wooded. The bench lands above the river are mostly level prairie, much of which is now under cultivation.

The mean annual rainfall at Moosejaw is fourteen inches, at Regina fifteen inches, and at Indian Head nineteen inches. The streams are frozen during the winter months, and there is usually an abundant snowfall.

There are several irrigation and many industrial water rights in this basin.

The spring of 1916 was marked by exceptionally high water in Qu'Appelle river for a short period due to rapid melting of the snow cover on the drainage basin.

QU'APPELLE RIVER AT LUMSDEN

Location.—On NW. ¼ Sec. 33, Tp. 19, Rge. 21, W. 2nd Mer., at J. G. Miller's farm near Lumsden, Sask.

Records available.—May 12, 1911, to December 31, 1916.

Gauge.—Vertical staff; zero of gauge maintained at elevation of 85.35 feet during 1911-13; and at elevation of 85.16 feet during 1914-16.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—Permanent, but debris on control affects gauge heights.

Discharge measurements.—By wading or from bridge.

Winter flow.—Affected by ice.

Observers.—J. G. Miller and W. J. Steele.

DISCHARGE MEASUREMENTS of Qu'Appelle river at Lumsden, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 11	F. R. Shenstone	10.4	3.98	0.13	1.88	0.53
Feb. 9	do	4.5	1.30	0.11	1.74	0.14
Mar. 11	do	4.2	1.28	0.04	1.56	0.06
Mar. 31	do	5.5	3.00	0.32	2.00	0.96
April 18	do	105.0	1,119.00	2.33	.....	2,617.00*x*
April 19	do	105.0	1,109.00	2.16	.....	2,401.00*x*
April 26	V. A. Newhall	84.0	1,304.00	1.74	23.38	2,332.00
May 22	F. R. Shenstone	27.0	209.00	1.41	7.15	294.00
June 14	do	27.0	194.00	1.31	6.66	256.00
July 21	J. R. Estey	26.0	140.00	0.67	4.56	94.00
Aug. 12	do	26.0	128.00	0.57	3.97	73.00*p*
Sept. 1	F. R. Shenstone	19.0	27.00	1.19	3.24	32.00
October 5	do	19.5	22.70	1.17	2.98	27.00
Nov. 3	do	26.0	35.60	1.04	3.37	37.00
Nov. 23	do	21.0	20.40	0.93	2.88	18.90*i*

i Stream frozen over.

x Measurements made at Craven, Sec. 23, Tp. 20, Rge. 21, W. 2nd Mer., because of flood conditions at Lumsden; and includes discharge of Boggy and Flying creeks.

p Unfavourable conditions; velocity very low, area large.

DAILY GAUGE HEIGHT AND DISCHARGE of Qu'Appelle river at Lumsden, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.00*b*	1.30	1.81	0.27	1.58	0.05	9.40	20*g*	18.31	1,540	6.59	247
2	1.98	1.20	1.80	0.25	1.57	0.05	13.82	60	17.01	1,355	6.67	253
3	1.96	1.10	1.78	0.24	1.58	0.05	14.35	100	16.02	1,225	6.75	259
4	1.99	1.02	1.78	0.20	1.60	0.05	14.34	120	15.88	1,200	6.97	276
5	1.95	0.95	1.77	0.15	1.61	0.05	14.26	140	15.18	1,110	7.11	288
6	1.93	0.86	1.76	0.14	1.58	0.04	11.77	160	12.55	800	7.17	293
7	1.92	0.82	1.75	0.13	1.55	0.03	11.23	180	12.73	820	7.15	291
8	1.90	0.73	1.75	0.12	1.57	0.03	9.98	200	11.47	685	7.23	298
9	1.90	0.65	1.74	0.14	1.56	0.03	9.09	300	10.48	580	7.22	297
10	1.89	0.60	1.73	0.14	1.54	0.03	10.94	500	9.98	534	7.19	294
11	1.87	0.53	1.74	0.14	1.54	0.06	12.44	900	9.95	532	6.96	276
12	1.88	0.52	1.75	0.15	1.53	0.05	15.94	1,500	9.82	520	6.77	260
13	1.86	0.45	1.73	0.15	1.50	0.04	17.74	1,600	9.66	505	6.70	255
14	1.81	0.40	1.73	0.17	1.51	0.03	19.04	1,700	8.76	425	6.67	253
15	1.77	0.38	1.72	0.21	1.50	0.04	19.69	1,800*g*	8.13	372	6.68	254
16	1.72	0.37	1.71	0.24	1.50	0.05	20.94	1,940	7.83	347	6.67	253
17	1.74	0.35	1.71	0.25	1.51	0.06	21.89	2,090	7.72	338	6.64	251
18	1.76	0.35	1.70	0.25	1.53	0.08	22.62	2,205	7.68	334	6.62	249
19	1.77	0.35	1.69	0.24	1.52	0.10	23.16	2,295	7.62	330	6.62	249
20	1.79	0.33	1.70	0.23	1.54	0.13	23.38	2,330	7.50	320	6.59	247
21	1.82	0.32	1.69	0.22	1.54	0.17	23.65	2,380	7.39	311	6.58	246
22	1.84	0.31	1.67	0.21	1.53	0.20	23.88	2,413	7.18	293	6.58	246
23	1.89	0.31	1.65	0.18	1.54	0.27	22.64	2,210	6.93	273	6.54	243
24	1.91	0.32	1.63	0.15	1.56	0.32	23.84	2,408	6.87	269	6.50	240
25	1.96	0.33	1.59	0.13	1.58	0.35	23.68	2,380	6.80	263	6.43	234
26	1.92	0.32	1.57	0.12	1.60	0.36	23.38	2,332*d*	6.84	266	6.32	226
27	1.93	0.32	1.59	0.10	1.61	0.40	22.30	2,158	6.82	265	5.96	198
28	1.90	0.30	1.58	0.08	1.59	0.42	20.91	1,935	6.80	263	5.43	156
29	1.87	0.28	1.56	0.07	1.64	0.60	20.44	1,862	6.78	262	5.29	146
30	1.82	0.27	.....	.....	1.75	0.80	19.00	1,640	6.62	249	5.32	148
31	1.80	0.27	.....	.....	2.00*b*	1.00	.....	.....	6.61	248	.....	.....

b-b Ice conditions; discharge determined from winter graph.
d Actual measurement.
g Ice going out; discharge estimated.

PLATE 13

View showing Qu'Appelle river in flood at Lumsden, Saskatchewan, in April, 1916.
Taken on April 26, 1916, by V. A. Newhall.

PLATE 14

Another view of flooding from Qu'Appelle river at Lumsden, in April, 1916.
Taken on April 26, 1916, by V. A. Newhall.

DAILY GAUGE HEIGHT AND DISCHARGE of Qu'Appelle river at Lumsden, for 1916.—*Concluded.*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	5.31	147	4.20	72	3.24	34	3.05	29	3.59	44.0	2.85	13.0
2	5.40	154	4.09	66	3.16	32	3.08	30	3.55	43.0	2.81	12.5
3	5.34	149	4.12	68	3.10	30	3.18	32	3.50	41.0	2.79	12.0
4	5.19	138	4.12	68	3.04	29	3.22	33	3.49	41.0	2 82	11.3
5	5.08	130	4.05	64	3.08	30	2.98	27	3.48	40.0	2.84	10.8
6	5.31	147	4.04	64	3.06	29	3.17	32	3.49	41.0	2.80	10.4
7	5.38	152	3.90	57	3.08	30	3.22	33	3.45	40.0	2.79	10.0
8	5.30	146	3.90	57	3.10	30	3.22	33	3.40	38.0	2.76	9.7
9	5.22	140	4.04	64	3.11	30	3.27	34	3.39	38.0	2.73	9.4
10	5.22	140	4.01	62	3.51	41	3.27	34	3.24	34.0	2.72	9.0
11	5.34	149	4.04	64	3.58	44	3.18	32	.....	30.0*a*	2.69	8.5
12	5.14	134	3.96	60	3.46	40	3.08	30	2.95	26.0	2.67	8.0
13	5.00	124	3.83	54	3.45	40	3.02	28	2.87*b*	30.0	2.65	7.5
14	4.98	123	3.73	50	3.47	40	3.01	28	2.79	30.0	2.63	7.0
15	4.91	117	3.70	49	3.38	38	2.96	27	.....	30.0*a*	2.60	6.7
16	4.88	115	3.68	48	3.32	36	2.99	27	2.67	30.0	2.58	6.3
17	4.84	112	3.64	46	3.27	34	2.97	27	2.64	29.0	2.61	5.9
18	4.74	106	3.59	44	3.16	32	2.92	26	2.66	28.0	2.64	5.5
19	4.71	104	3.55	43	3.04	29	2.90	25	2.68	27.0	2.63	5.2
20	4.63	98	3.58	44	3.22	33	2.90	25	2.65	25.0	2.60	5.0
21	4.59	96	3.60	45	3.13	31	2.99	27	2.67	23.0	2.61	4.6
22	4.50	90	3.50	41	3.20	33	3.03	28	.....	21.0*a*	2.58	4.2
23	4.49	89	3.43	39	3.22	33	3.06	29	2.88	18.9	2.56	3.9
24	4.42	84	3.46	40	3.06	29	3.14	31	2.86	17.7	2.53	3.4
25	4.33	79	3.42	39	3.09	30	3.34	36	2.92	16.8	2.50	3.3
26	4.21	73	3.42	39	3.19	32	3.54	43	2.96	16.0	2.49	3.0
27	4.12	68	3.43	39	3.32	36	3.64	46	2.98	15.3	2.49	3.0
28	4.21	73	3.42	39	3.24	34	3.59	44	2.93	14.6	2.36	2.9
29	4.25	75	3.36	37	3.17	32	3.63	46	2.89	14.0	2.36	2.8
30	4.32	79	3.28	35	3.13	31	3.65	47	2.87	13.7	2.39	2.5
31	4.31	78	3.24	34	.....	.....	3.61	45	.....	.....	2.42*b*	2.4

b-b Ice conditions; discharge determined from winter graph.
a Discharge estimated.

MONTHLY DISCHARGE of Qu'Appelle river at Lumsden, for 1916

(Drainage area 6,160 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	1.30	0.27	0.54	0.00009	0.00010	33
February	0.27	0.27	0.18	0.00003	0.00003	10
March	1.00	0.03	0.19	0.00003	0.00003	12
April	2,413.00	20.00	1,395.00	0.22600	0.25000	82,988
May	1,540.00	248.00	543.00	0.08800	0.01000	33,388
June	298.00	146.00	248.00	0.04000	0.04000	14,757
July	154.00	68.00	113.00	0.01800	0.02000	6,948
August	72.00	34.00	51.00	0.00800	0.00900	3,136
September	44.00	29.00	33.00	0.00500	0.00600	1,964
October	47.00	25.00	33.00	0.00500	0.00600	2,029
November	44.00	13.70	28.00	0.00500	0.00600	1,666
December	13.00	2.40	6.80	0.00100	0.00100	418
The year	.....	.....	.....	.....	0.34816	147,349

MEAN MONTHLY DISCHARGE in Second-feet of Qu'Appelle river at Lumsden

MONTH	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	15.40	23.60	9.16	6.00	9.30	33.00	16.10	973
November	.....	3.72	16.60	7.47	4.40	3.80	28.00	10.70	621
December	.....	2.77	2.71	3.80	2.40	2.10	6.80	3 40	211
January	.....	0.73	1.09	1.14	0.77	0.54	.....	0.85	173
February	.....	0.36	2.49	0.01	0.06	0.18	.....	0.62	34
March	.....	15.80	60.90	1.85	0.08	0.19	.....	15.80	969
April	.....	395.00	428.00	86.00	9.00	1,395.00	.....	463.00	27,523
May	83.90*a*	523.00	82.00	33.00	11.20	543.00	.....	238.00	14,661
June	133.00	158.00	46.40	24.00	7.60	248.00	.....	103.00	6,119
July	42.60	86.40	46.80	19.80	5.90	113.00	.....	52.00	3,223
August	12 90	34.10	31.20	7.50	2.60	51.00	.....	23.00	1,428
September	32.40	29.00	15.40	5.40	3.70	33.00	.....	20.00	1,176
Total in Acre-ft.	16,582	76,400	46,142	11,999	3,254	144,163	.....	.....	57,111

a 12-31.

MOOSEJAW CREEK DRAINAGE BASIN

General Description

Moosejaw creek rises in the Yellowgrass marsh, which lies in Townships 9 and 10, Range 17, West of the 2nd Meridian, and flows in a northerly and westerly direction until it reaches the city of Moosejaw, where it is joined by Thunder creek. From Moosejaw it follows an easterly and northerly course, finally emptying into the Qu'Appelle river near Buffalo Pound lake. From the headwaters to the city of Moosejaw the drainage area is estimated at about 1,830 square miles. This area is almost entirely devoid of tree growth, except in the vicinity of Moosejaw, where the valley is lined with brush.

Throughout its entire length the creek flows in a very crooked but well defined channel. The upper portion of the valley is small, being merely a depression, but it gradually increases in size until at Drinkwater it is about thirty feet deep and at Moosejaw eighty feet deep. The fall in the creek is very small, and particularly so between Drinkwater and Moosejaw, where the total fall is only 67.5 feet or an average of 2.3 feet per mile of valley.

The Canadian Pacific Railway Company has dams at Milestone, Rouleau, Drinkwater, two at Moosejaw and one at Pasqua. There is also a municipality dam in Section 19, Township 15, Range 24, West of the 2nd Meridian, which supplies water to the neighbourhood during periods when there is no flow in the creek. In 1913 the Canadian Pacific Railway Company constructed a new dam to replace their old dam in Moosejaw.

The spring of 1916 was marked by exceptionally high water in Moosejaw creek for a short period, due to the rapid melting of the snow cover on the basin.

MOOSEJAW CREEK NEAR LANG

Location.—On traffic bridge on road allowance, east of the NE. ¼ Sec. 24, Tp. 11, Rge. 19, W. 2nd Mer., four miles west of the village of Lang.

Records available.—From June 21, 1911, to October 31, 1916.

Gauge.—Vertical staff. Zero elevation of gauge was maintained at 94.80 feet during 1911, 95.07 feet during 1912-13, 95.04 feet during 1914-16.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—Permanent.

Discharge measurements.—From bridge or by wading.

Winter flow.—No winter observations have been taken.

Observer.—Miss Irene Irvine.

Monthly Discharge of Qu'Appelle river at Lumsden, for 1912

(Drainage area 6,160 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	1.97	0.33	0.727	0.0001	0.0001	45
February	40.40	0.33	0.355	0.0001	0.0001	20
March	166.00	0.26	15.800	0.0020	0.0020	971
April	867.00	94.00	395.000	0.0640	0.0710	23,504
May	884.00	81.00	523.000	0.0840	0.0970	32,158
June	308.00	68.00	158.000	0.0260	0.0290	9,402
July	128.00	55.00	86.400	0.0140	0.0160	5,312
August	48.00	27.00	34.100	0.0060	0.0070	2,097
September	37.00	21.00	29.000	0.0050	0.0060	1,726
October	30.00	19.00	23.600	0.0040	0.0050	1,451
November	24.00	2.98	16.600	0.0030	0.0030	988
December	3.24	2.36	2.710	0.0004	0.0010	167
The year					0.2370	77,841

This table is inserted in this report to correct a table which was published on page 425 of the report for 1912. The records for the month of June and the total run-off depth in inches were incorrect as then published.

Monthly Discharge of Qu'Appelle river at Lumsden, for 1913

(Drainage area 6,160 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	3.4	0.0	1.09	0.0002	0.0002	67
February	3.7	0.6	2.49	0.0004	0.0004	138
March	163.0	0.0	60.90	0.0090	0.0100	3,745
April	807.0	101.0	428.00	0.0700	0.0800	25,468
May	107.0	62.0	82.00	0.0130	0.0140	5,042
June	79.0	25.0	46.40	0.0070	0.0080	2,761
July	83.0	30.0	46.80	0.0070	0.0080	2,878
August	46.0	21.0	31.20	0.0050	0.0060	1,918
September	25.0	8.0	15.40	0.0020	0.0020	916
October	13.1	5.0	9.16	0.0010	0.0010	563
November	9.0	6.1	7.47	0.0010	0.0010	444
December	6.9	2.2	3.80	0.0006	0.0010	234
The year					0.1320	44,174

This table is inserted in this report to correct a table which was published on page 383 of the report for 1913. The records for the month of January and the totals were incorrect as then published.

DISCHARGE MEASUREMENTS of Moosejaw creek near Lang, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
May 16	F. R. Shenstone	35.5	59.6	0.06	1.97	3.62
June 8	do	.....	.....	.....	2.05	4.00*e*

e Discharge estimated from field inspection.

DAILY GAUGE HEIGHT AND DISCHARGE of Moosejaw creek near Lang, for 1916

Day	April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	3.42	10.0	1.66	2 4
2	.....	.....	3.45	10.2	1.63	2 3
3	.....	.....*g*	3 30	9.5	1.61	2.3
4	.....	.....	3.10	8.6	1.60	2.2
5	.....	.....	2.50	6.0	1.59	2.2
6	.....	.....	2.78	7.2	1.95	3.6
7	.....	.....	2.66	6.7	2.02	3.9
8	.....	.....	2.52	6.1	2.05	4.0
9	.....	.....	2.37	5.4	2.00	3.8
10	.....	.....	2.28	5.0	1.95	3.6
11	.....	.....	1.96	3.6	1.90	3.4
12	.....	.....	2.00	3.8	1.86	3.2
3	.....	.....	2.00	3.8	1.80	2.9
	.....	.....	2.05	4.0	1.77	2.8
	.....	.....	2.00	3.8	1.75	2.7
16	.....	.....	1.90	3.4	1.70	2.5
17	.....	.....	1.86	3.2	1.67	2.4
18	.....	.....	1.80	3.1	1.65	2.4
19	.....	.....	1.77	2.8	1.61	2.3
20	.....	.....	1.73	2.7	1.60	2.2
21	.....	.....	1.70	2.5	1.59	2.2
22	.....	.....	1.69	2.5	1.58	2.2
'3	.....	.....	1.65	2.4	1.57	2 2
	4.14	13.2	1.70	2.5	1.60	2.2
	4.45	14.6	1.75	2.7	1.59	2.2
	4.15	13.3	1.84	3.1	1.58	2.2
27	3.85	11.9	1.82	3.0	1.57	2.2
28	3.50	10.4	1.80	2.9	1.57	2.2
29	3.30	9.5	1.78	2.9	1.75	2.7
30	3.40	10.0	1.75	2.7	1.73	2.7
31	.....	.....	1.70	2.5	.....	.....

g Stream started to break up on April 3.

DAILY GAUGE HEIGHT AND DISCHARGE of Moosejaw creek near Lang, for 1916—*Concluded*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.71	2.60	1.45	1.83	0.78	0.68	0.36	0.47
2	1.70	2.50	1.43	1.78	0.75	0.67	0.34	0.47
3	1.70	2.50	1.40	1.71	0.72	0.65	0.33	0.46
4	1.70	2.50	1.37	1.64	0.68	0.63	0.37	0.48
5	1.69	2.50	1.37	1.64	0.60	0.58	0.37	0.48
6	1.69	2.50	1.40	1.71	0.57	0.56	0.39	0.49
7	1.66	2.40	1.36	1.62	0.55	0.55	0.42	0.50
8	1.64	2.40	1.36	1.62	0.50	0.53	0.45	0.45
9	1.62	2.30	1.47	1.88	0.48	0.52	0.46	0.51
10	1.60	2.20	1.54	2.10	0.55	0.55	0.44	0.51
11	1.56	2.10	1.51	1.99	0.53	0.54	0.42	0.50
12	1.50	1.96	1.47	1.88	0.51	0.53	0.40	0.49
13	1.45	1.83	1.41	1.73	0.58	0.59	0.43	0.50
14	1.42	1.76	1.40	1.71	0.56	0.56	0.41	0.49
15	1.40	1.71	1.38	1.67	0.54	0.55	0.40	0.49
16	1.37	1.64	1.36	1.62	0.58	0.57	0.39	0.49
17	1.35	1.60	1.30	1.50	0.56	0.56	0.41	0.49
18	1.47	1.88	1.25	1.40	0.54	0.55	0.39	0.49
19	1.45	1.83	1.15	1.22	0.52	0.54	0.38	0.48
20	1.43	1.78	1.09	1.11	0.50	0.53	0.36	0.47
21	1.42	1.76	1.07	1.08	0.48	0.52	0.34	0.46
22	1.40	1.71	1.06	1.07	0.45	0.50	0.38	0.48
23	1.39	1.69	1.05	1.05	0.43	0.50	0.40	0.49
24	1.36	1.62	1.00	0.98	0.41	0.49	0.42	0.50
25	1.40	1.71	0.96	0.92	0.41	0.49	0.44	0.51
26	1.40	1.71	0.94	0.89	0.41	0.49	0.42	0.50
27	1.39	1.69	0.92	0.86	0.41	0.49	0.40	0.49
28	1.42	1.76	0.90	0.83	0.41	0.49	0.38	0.48
29	1.40	1.71	0.87	0.79	0.40	0.49	0.36	0.47
30	1.39	1.69	0.85	0.76	0.38	0.48	0.35	0.47
31	1.37	1.64	0.80	0.70	.....	.....	0.34	0.47

MONTHLY DISCHARGE of Moosejaw creek near Lang, for 1916

(Drainage area 189 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
April (24-30)	14.60	9.50	11.90	0.063	0.016	165
May	10.20	2.40	4.50	0.024	0.030	277
June	4.00	2.20	2.70	0.014	0.020	161
July	2.60	1.62	1.97	0.010	0.010	121
August	2.10	0.70	1.39	0.007	0.008	85
September	0.68	0.48	0.55	0.003	0.003	33
October	0.51	0.45	0.48	0.003	0.003	30
The period	.....	.....	.....	.....	0.090	872

MEAN MONTHLY DISCHARGE in Second-feet of Moosejaw creek near Lang

MONTH	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	3.90*b*	Nil	Nil	Nil	Nil	0.48	0.10	6
November	.....	.....	"	"	"	"	.....	.....	.....
December	.....	.....	.....	"	"	"	.....	.....	.....
January	.....	.....	.....	"	"	"	.....	.....	.....
February	.....	.....	.....	"	"	"	.....	.....	.....
March	.....	.....	.....	.....*d*	"	"	.....	.....	.....
April	.....	38.00	5.70*c*	31.00	"	11.90*f*	.....	23.00	1,365
May	.....	51.00	0.43	3.10	"	4.50	.....	11.80	730
June	1.46*a*	22.00	Nil	0.80	"	2.70	.....	5.10	301
July	3.90	5.30	"	0.11	"	1.97	.....	1.88	116
August	4.90	0.95	"	Nil	"	1.39	.....	1.21	74
September	2.30	0.07	"	"	"	0.55	.....	0.49	29
Total in acre-feet	705	7,310	206	2,091	Nil	842	.....	.....	2,621

a 21-30.
b 1-28.
c 15-30.
d Spring freshet, but no definite records of it.
f 24-30.

MOOSEJAW CREEK AT MCCARTHY'S FARM

Location.—On the NW. ¼ Sec. 16, Tp. 16, Rge. 26, W. 2nd Mer., about three miles south of Moosejaw.

Records available.—April 7, 1910, to December 31, 1915.

Gauge.—Vertical staff; zero elevation maintained at 83.03 feet during 1910-11; zero elevation maintained at 82.99 feet during 1912-13; zero elevation maintained at 81.99 feet during 1914-16.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—Permanent.

Discharge measurements.—With current-meter from bridge or by wading.

Observer.—Miss Sadie McCarthy.

Remarks.—Serious floods resulted from the melting snows in Moosejaw creek valley in the spring of 1916. The Canadian Pacific railway dam at Moosejaw was broken and serious inconvenience was experienced by the flooding of houses in the low flats.

DISCHARGE MEASUREMENTS of Moosejaw creek at McCarthy's farm, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Feb. 11	F. R. Shenstone	.....	.....	.....	Dry	Nil
Mar. 30	J. C. Keith	33	128.0	2.49	6.11	320.00
April 3	F. R. Shenstone	52	175.0	1.84	5.87	322.00
April 10	J. C. Keith	88	590.0	1.86	11.51	1,097.00
April 19	V. A. Newhall	104	1,244.0	2.13	16.73	2,648.00
April 20	do	103	1,193.0	2.10	15.91	2,508.00
April 27	do	103	673.0	1.97	10.78	1,325.00
May 15	F. R. Shenstone	32	86.0	1.02	3.29	87.00
June 7	do	32	73.0	0.57	2.85	42.00
July 8	do	26	11.5	1.34	2.60	15.40
July 31	J. R. Estey	20	6.6	0.30	2.15	1.98
Aug. 18	do	19	7.2	0.14	2.11	0.96
Sept. 2	F. R. Shenstone	16	2.2	0.17	2.07	0.36
Oct. 6	do	20	4.6	0.48	2.15	2.24
Nov. 4	do	23	8.4	1.88	2.31	7.40
Nov. 24	do	18	5.7	0.66	2.19	3.80
Dec. 18	do	6	1.8	0.34	2.28	0.62

DAILY GAUGE HEIGHT AND DISCHARGE of Moosejaw creek at McCarthy's farm, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	Dry	Nil	Dry	Nil	0.60	Nil	6.63	340	8.05	770.0	2.32	11.0
2	"	"	"	"	0.45	"	6.51	340	7.33	631.0	2.52	21.0
3	"	"	"	"	0.34	"	6.09	350	6.59	504.0	2.89	45.0
4	"	"	"	"	0.20	"	4.93	400	5.79	384.0	2.91	47.0
5	"	"	"	"	0.12	"	4.41	450	5.25	302.0	2.95	50.0
6	"	"	"	"	0.08	"	3.89	500	4.84	247.0	3.01	54.0
7	"	"	"	"	0.10	"	6.31	800	4.54	208.0	2.87	45.0
8	"	"	"	"	1.38	"	9.01	900	4.17	163.0	2.67	30.0
9	"	"	"	"	1.50	"	10.93*g*	1,000	3.95	140.0	2.77	37.0
10	"	"	"	"	1.70	"	11.53	1,093	3.77	122.0	2.95	50.0
11	"	"	"	"	1.78	"	11.61	1,107	3.67	112.0	3.00	53.0
12	"	"	"	"	1.87	"	12.19	1,218	3.58	103.0	3.03	55.0
13	"	"	"	"	1.96	"	13.81	1,562	3.46	91.0	3.09	59.0
14	"	"	"	"	1.96	"	17.06	2,325	3.37	82.0	3.09	59.0
15	"	"	1.08	"	1.96	"	18.95	2,798	3.28	73.0	3.10	60.0
16	"	"	1.14*x*	"	1.96	"	19.05	2,822	3.21	68.0	3.07	58.0
17	"	"	1.17	"	1.98	"	18.71	2,738	3.11	61.0	3.00	53.0
18	"	"	1.18	"	1.99	"	17.97	2,958	3.00	53.0	2.95	50.0
19	"	"	1.19	"	2.07	"	16.76	2,671	2.91	47.0	2.87	44.0
20	"	"	1.23	"	2.15	"	15.76	2,440	2.75	36.0	2.77	37.0
21	"	"	1.27	"	2.15	"	14.73	2,204	2.64	28.0	2.73	34.0
22	"	"	1.27	"	2.15	"	13.69	1,972	2.53	22.0	2.70	32.0
23	"	"	1.22	"	2.15	"	12.73	1,759	2.43	16.5	2.67	30.0
24	"	"	1.19	"	2.15	"	12.39	1,683	2.36	13.0	2.61	27.0
25	"	"	1.12	"	2.13	"	11.87	1,568	2.37	13.5	2.57	24.0
26	"	"	1.07	"	2.14*x*	"	11.28	1,434	2.44	17.0	2.49	19.5
27	"	"	1.00	"	2.60	10	10.67	1,299	2.39	14.5	2.55	23.0
28	"	"	0.88	"	3.95*g*	50	10.09	1,178	2.35	12.5	2.59	25.0
29	"	"	0.74	"	4.86	100	9.47	1,054	2.33	11.5	2.65	29.0
30	"	"	.....	.....	5.99	320	8.87	934	2.34	12.0	2.66	30.0
31	"	"	.....	.....	6.67	340	.....	.....	2.34	12.0	.....	.....

x-x Water standing on ice.
g-g Ice going out; discharge estimated. Maximum gauge height 19.11 on April 15.

DAILY GAUGE HEIGHT AND DISCHARGE of Moosejaw creek at McCarthy's farm, for 1916
—*Concluded*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.62	27.0	2.16	4.4	2.10	2.00	2.10	2.00	2.33	11.5	2.16	4.40
2	2.58	25.0	2.15	4.0	2.07	1.40	2.09	1.80	2.32	11.0	2.16	4.40
3	2.52	21.0	2.15	4.0	2.07	1.40	2.10	2.00	2.32	11.0	2.15	4.00
4	2.48	19.0	2.14	3.6	2.07	1.40	2.10	2.00	2.31	10.5	2.14	3.60
5	2.45	17.5	2.14	3.6	2.08	1.60	2.13	3.20	2.33	11.5	2.13	3.20
6	2.41	15.5	2.12	2.8	2.08	1.60	2.14	3.60	2.36	13.0	2.12	2.80
7	2.47	18.5	2.11	2.4	2.09	1.80	2.18	5.20	2.36	13.0	2.10	2.00
8	2.47	18.5	2.11	2.4	2.09	1.80	2.23	7.20	2.34	12.0	2.11	2.40
9	2.47	18.5	2.11	2.4	2.10	2.00	2.22	6.80	2.36	13.0	2.12	2.80
10	2.41	17.0	2.11	2.4	2.10	2.00	2.23	7.20	2.38*b*	14.0	2.14	3.60
11	2.41	15.5	2.11	2.4	2.11	2.40	2.23	7.20	2.40	15.0	2.14	3.60
12	2.37	13.5	2.11	2.4	2.11	2.40	2.22	6.80	2.42	16.0	2.15	4.00
13	2.32	11.0	2.12	2.8	2.11	2.40	2.22	6.80	2.42	16.0	2.12	2.80
14	2.29	9.6	2.11	2.4	2.11	2.40	2.22	6.80	2.40	15.0	2.12	2.80
15	2.28	9.2	2.11	2.4	2.11	2.40	2.27	8.80	2.40	15.0	2.12	2.80
16	2.27	8.8	2.10	2.0	2.11	2.40	.....	13.40*e*	2.40	15.0	2.16	4.40
17	2.26	8.4	2.10	2.0	2.11	2.40	2.46	18.00	2.40	15.0	2.22	2.50
18	2.27	8.8	2.10	2.0	2.11	2.40	2.64	28.00	2.39	14.5	2.29	0.62
19	2.25	8.0	2.11	2.4	2.11	2.40	2.65	29.00	2.38	14.0	2.29	0.59
20	2.25	8.0	2.10	2.0	2.10	2.00	2.56	24.00	2.37	13.5	2.30	0.56
21	2.24	7.6	2.10	2.0	2.09	1.80	2.53	22.00	2.20	6.0	2.30	0.53
22	2.23	7.2	2.10	2.0	2.09	1.80	2.49	19.50	2.20	6.0	2.30	0.50
23	2.21	6.4	2.10	2.0	2.08	1.60	2.45	17.50	2.19	5.6	2.30	0.47
24	2.19	5.6	2.11	2.4	2.08	1.60	2.44	17.00	2.18	5.2	2.29	0.44
25	2.18	5.2	2.11	2.4	2.08	1.60	2.40	15.00	2.18	5.2	2.29	0.41
26	2.18	5.2	2.11	2.4	2.09	1.80	2.38	14.00	2.18	5.2	2.29	0.38
27	2.17	4.8	2.11	2.4	2.10	2.00	2.38	14.00	2.18	5.2	2.28	0.35
28	2.17	4.8	2.11	2.4	2.11	2.40	2.37	13.50	2.17	4.8	2.27	0.32
29	2.17	4.8	2.10	2.0	2.13	3.20	2.38	14.00	2.16	4.4	2.25	0.29
30	2.17	4.8	2.10	2.0	2.12	2.80	2.38	14.00	2.16	4.4	2.21	0.26
31	2.16	4.4	2.10	2.0	.....	.....	2.36	13.00	.....	.....	2.15*b*	0.25

e Discharge estimated.
b-b Ice conditions.

MONTHLY DISCHARGE of Moosejaw creek at McCarthy's farm, for 1916

(Drainage area 1,719 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	0.0	0.00	0.0	0.000	0.000	.....
February	0.0	0.00	0.0	0.000	0.000	.....
March	340.0	Nil	26.0	0.015	0.017	1,599
April	2,958.0	340.00	1,463.0	0.851	0.950	87,034
May	770.0	11.50	142.0	0.083	0.090	8,731
June	60.0	11.00	40.0	0.023	0.020	2,380
July	27.0	4.40	11.6	0.007	0.008	713
August	44.0	2.00	2.5	0.001	0.001	154
September	3.2	1.40	2.0	0.001	0.001	119
October	29.0	1.80	11.7	0.007	0.008	719
November	16.0	4.40	10.7	0.006	0.007	637
December	4.4	0.25	2.0	0.001	0.001	123
The year	.....	.....	.....	.....	1.103	102,209

MEAN MONTHLY DISCHARGE in Second-feet of Moosejaw creek at McCarthy's Farm

MONTH	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	Nil	11.50	1.93	0.20	Nil	Nil	11.70	3.60	222
November	.....	.....	4.20	1.32	0.38	2.40	"	10.70	3.20	188
December	.....	.....	0.55	0.05	0.10	0.34	"	2.00	0.51	31
January	.....	.....	0.04	Nil	Nil	Nil	"	.....	0.01	1
February	.....	.....	Nil	"	"	"	"	.....	Nil	Nil
March	.....	32.00*b*	..... *c*	"	9.10	"	26.00	.....	8.80	539
April	6.80*a*	188.00	257.00*d*	87.00*f*	73.00	1.47	1,463.00	.....	431.00	25,663
May	29.00	38.00	521.00	6.40	5.60	0.41	142.00	.....	106.00	6,522
June	23.00	71.00	49.00	0.98	3.40	0.28	40.00	.....	27.00	1,593
July	1.18	2.80	24.00	12.10	0.43	0.13	11.60	.....	7.50	459
August	Nil	0.21	2.90	0.64	Nil	Nil	2.50	.....	0.89	55
September	"	0.08	0.94	0.12	"	"	2.00	.....	0.45	27
Total in acre-feet	3,547	26,151	50,923	5,242	5,515	304	100,730	.....	.....	35,300

a 7-30.
b 19-31.
c Not sufficient data to compute discharge.
d 5-30.
f 9-30.

SANDY CREEK NEAR CARON

Location.—On the SE. ¼ Sec. 29, Tp. 17, Rge. 29, W. 2nd Mer.
Records available.—August 1 to October 7, 1916.
Gauge.—Vertical staff; zero maintained at elevation of weir crest since establishment.
Discharge measurements.—From thirty-inch trapezoidal weir. Daily observations of head taken by observer.
Observer.—James Grazier.
Remarks.—One discharge measurement only in 1916. Observations were furnished gratis by Mr. Grazier, an employee of the city of Moosejaw.

DISCHARGE MEASUREMENTS of Sandy creek near Caron, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Sept. 11	F. R. Shenstone	.....	.....	.....	0.16	0.538*w*

w Discharge determined by using a 30-inch weir.

DAILY GAUGE HEIGHT AND DISCHARGE of Sandy creek near Caron, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	0.140	0.42	0.100	0.28	0.100	0.28	4.60	.....	0.47	2.70	0.45	2.50
2	0.135	0.41	0.100	0.28	0.100	0.28	4.60	.....	0.47	2.70	0.44	2.40
3	0.135	0.41	0.100	0.28	0.100	0.28	4.60	.....	0.46	2.60	0.42	2.30
4	0.130	0.40	0.100	0.28	0.100	0.28	3.50	.....	0.46	2.60	0.39	2.00
5	0.130	0.40	0.100	0.28	0.100	0.28	2.70	.....	0.45	2.50	0.41	2.20
6	0.130	0.40	0.100	0.28	0.100	0.28	2.00	.....	0.45	2.50	0.45	2.50
7	0.120	0.38	0.100	0.28	0.100	0.28	1.60	.....	0.43	2.40	0.47	2.70
8	0.130	0.40	0.100	0.28	0.100	0.28	1.50	.....	0.43	2.40	0.47	2.70
9	0.120	0.38	0.100	0.28	0.100	0.28	1.50	.....	0.42	2.30	0.47	2.70
10	0.110	0.32	0.100	0.28	0.100	0.28	1.50	.....	0.40	2.10	0.47	2.70
11	0.100	0.28	0.100	0.28	0.150	0.48	1.00	.....	0.40	2.10	0.45	2.50
12	0.100	0.28	0.100	0.28	0.200	0.75	1.00	.....	0.40	2.10	0.43	2.40
13	0.100	0.28	0.100	0.28	0.170	0.58	1.60	.....	0.40	2.10	0.42	2.30
14	0.100	0.28	0.100	0.28	0.150	0.48	2.00	.....	0.40	2.10	0.39	2.00
15	0.100	0.28	0.100	0.28	0.140	0.42	1.50	.....	0.39	2.00	0.38	1.98
16	0.100	0.28	0.100	0.28	0.130	0.40	1.20	.....	0.39	2.00	0.36	1.85
17	0.100	0.28	0.100	0.28	0.110	0.32	1.20	.....	0.39	2.00	0.35	1.78
18	0.140	0.42	0.100	0.28	0.110	0.32	1.00	.....	0.38	1.98	0.34	1.70
19	0.130	0.40	0.100	0.28	0.180	0.62	1.00	.....	0.38	1.98	0.33	1.62
20	0.130	0.40	0.100	0.28	0.200	0.75	1.00	.....	0.36	1.85	0.33	1.62
21	0.120	0.38	0.110	0.32	0.180	0.62	1.00	.....	0.36	1.85	0.32	1.55
22	0.100	0.28	0.140	0.42	0.150	0.48	1.00	.....	0.35	1.78	0.36	1.85
23	0.100	0.28	0.140	0.42	0.150	0.48	1.00	.....	0.34	1.70	0.42	2.30
24	0.100	0.28	0.140	0.42	0.150	0.48	1.00	.....	0.34	1.70	0.40	2.10
25	0.100	0.28	0.140	0.42	0.150	0.48	0.80	.....	0.45	2.50	0.40	2.10
26	0.100	0.28	0.150	0.48	0.150	0.48	0.70	5.0	0.49	2.90	0.39	2.00
27	0.100	0.28	0.150	0.48	0.200	0.75	0.50	3.0	0.52	3.20	0.37	1.92
28	0.100	0.28	0.140	0.42	0.300	1.40	0.50	3.0	0.52	3.20	0.36	1.85
29	0.100	0.28	0.120	0.38	0.400	2.10	0.50	3.0	0.49	2.90	0.38	1.98
30	0.100	0.28	.....	.....	6.000	.....	0.47	2.7	0.48	2.80	0.38	1.98
31	0.100	0.28	.....	.....	5.600	.....	.....	.....	0.46	2.60	.....	.....

No data available to compute discharge during flood period, March 30 to April 25.

DAILY GAUGE HEIGHT AND DISCHARGE of Sandy creek near Caron, for 1916.—*Concluded.*

DAY	July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	0.37	1.92	0.25	1.05	0.13	0.40	0.22	0.85
2	0.36	1.85	0.25	1.05	0.12	0.38	0.22	0.85
3	0.45	2.50	0.24	1.00	0.12	0.38	0.21	0.80
4	0.41	2.20	0.24	1.00	0.13	0.40	0.23	0.92
5	0.39	2.00	0.23	0.92	0.14	0.42	0.28	1.25
6	0.42	2.30	0.23	0.92	0.14	0.42	0.30	1.40
7	0.50	3.00	0.24	1.00	0.14	0.42	0.32	1.55
8	0.55	3.40	0.24	1.00	0.13	0.40	.....	.....
9	0.53	3.20	0.17	0.58	0.14	0.42	.....	.....
10	0.50	3.00	0.17	0.58	0.14	0.42	.....	.....
11	0.50	3.00	0.16	0.52	0.16	0.52	.....	.....
12	0.48	2.80	0.15	0.48	0.16	0.52	.....	.....
13	0.45	2.50	0.15	0.48	0.17	0.58	.....	.....
14	0.40	2.10	0.14	0.42	0.18	0.62	.....	.....
15	0.38	1.98	0.13	0.40	0.18	0.62	.....	.....
16	0.36	1.85	0.13	0.40	0.20	0.75	.....	.....
17	0.34	1.70	0.12	0.38	0.20	0.75	.....	.....
18	0.32	1.55	0.12	0.38	0.20	0.75	.....	.....
19	0.30	1.40	0.11	0.32	0.18	0.62	.....	.....
20	0.29	1.32	0.11	0.32	0.18	0.62	.....	.....
21	0.28	1.25	0.11	0.32	0.18	0.62	.....	.....
22	0.27	1.18	0.10	0.28	0.18	0.62	.....	.....
23	0.26	1.12	0.10	0.28	0.18	0.62	.....	.....
24	0.25	1.05	0.10	0.28	0.18	0.62	.....	.....
25	0.25	1.05	0.12	0.38	0.18	0.62	.....	.....
26	0.27	1.18	0.13	0.40	0.22	0.85	.....	.....
27	0.27	1.18	0.12	0.38	0.25	1.05	.....	.....
28	0.29	1.32	0.12	0.38	0.24	1.00	.....	.....
29	0.28	1.25	0.12	0.38	0.23	0.92	.....	.....
20	0.27	1.18	0.12	0.38	0.22	0.85	.....	.....
31	0.26	1.12	0.12	0.38	.....	.....	.....	.....

MONTHLY DISCHARGE of Sandy creek near Caron, for 1916

(Drainage area 92 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	0.42	0.28	0.33	0.004	0.00	20
February	0.48	0.28	0.32	0.003	0.00	18
March (1-29)	2.10	0.28	0.52	0.006	0.01	30
April (26-30)	5.00	2.70	3.30	0.036	0.01	33
May	3.20	1.70	2.30	0.025	0.03	141
June	2.70	1.55	2.10	0.023	0.03	125
July	3.40	1.05	1.69	0.018	0.02	104
August	1.05	0.28	0.55	0.006	0.01	34
September	1.05	0.38	0.61	0.007	0.01	36
October (1-7)	1.55	0.80	1.09	0.012	0.00	15
The period	.....	.....	.....	.....	0.12	556

SPRING (MILE 13) CREEK NEAR CARON

Location.—On the NE. ¼ Sec. 17, Tp. 17, Rge. 28, W. 2nd Mer.
Records available.—August 17 to December 31, 1916.
Gauge.—Vertical staff set above weir; zero elevation of gauge maintained at level of crest of weir.
Bench-mark.—None.
Channel.—Not likely to shift.
Discharge measurements.—Made with permanent six-inch weir, with current-meter by wading or from C.P.R. culvert.
Observer.—D. Weymss.

DISCHARGE MEASUREMENTS of Spring (Mile 13) creek near Caron, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Feb. 17	F. R. Shenstone					0.02*e*
Mar. 16	do					Nil
April 7	do					0.81*w*
July 29	J. R. Estey					0.02*w*
Aug. 17	do					Nil
Nov. 4	F. R. Shenstone					0.21*w*

w Weir measurement.
e Discharge estimated from field inspection.

DAILY GAUGE HEIGHT AND DISCHARGE of Spring (Mile 13) creek near Caron, for 1916

Day	August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1			Dry	Nil	0.25	0.19	0.28	0.22	0.05	0.02
2			"	"	...x...	...	0.24	0.18	0.06	0.02
3			"	"	...x...	...	0.21	0.15	0.05	0.02
4			"	"	...x...	...	0.25	0.19	0.10	0.05
5			"	"	...x...	...	0.27	0.21	0.15	0.09
6			"	"	...x...	...	0.28	0.22	Dry	Nil
7			"	"	0.40	0.35	0.29	0.23	"	"
8			"	"	...x...	...	0.26	0.20	"	"
9			"	"	...x...	...	0.26	0.20	"	"
10			"	"	...x...	...	0.29	0.23	"	"
11			0.20	0.14	...x...	...	0.25	0.19	"	"
12			Dry	Nil	...x...	...	0.10	0.05	"	"
13			"	"	...x...	...	Dry	Nil	"	"
14			0.06	0.02	...x...	...	"	"	"	"
15			0.05	0.02	0.42	0.37	"	"	"	"
16			0.10	0.05	...x...	...	"	"	"	"
17	Dry	Nil	0.16	0.10	...x...	...	"	"	"	"
18	"	"	0.10	0.05	...x...	...	0.25	0.19	"	"
19	"	"	0.05	0.02	...x...	...	0.25	0.19	"	"
20	"	"	Dry	Nil	...x...	...	0.25	0.19	"	"
21	"	"	"	"	...x...	...	0.24	0.18	"	"
22	"	"	"	"	0.38	0.33	0.23	0.17	"	"
23	"	"	"	"	0.36	0.31	0.19	0.13	"	"
24	"	"	0.08	0.04	...x...	...	0.14	0.08	"	"
25	"	"	0.12	0.07	0.36	0.31	0.10	0.05	"	"
26	"	"	...x...	...	0.34	0.28	0.08	0.04	"	"
27	"	"	...x...	...	0.36	0.31	0.05	0.02	"	"
28	"	"	...x...	...	0.40	0.35	0.06	0.02	"	"
29	"	"	0.25	0.19	0.46	0.42	0.07	0.03	"	"
30	"	"	...	...	0.38	0.33	0.06	0.02	"	"
31	"	"	...	...	...	...	...	...	"	"

x Observer absent, no gauge height recorded. Gauge heights represent the observed head on 6-inch weir.

SOURIS RIVER DRAINAGE BASIN

General Description

The source of the Souris river is in marshes near Yellow Grass, Saskatchewan. From here it flows in a southeasterly direction almost parallel to the Soo line of the Canadian Pacific railway to Estevan. It then flows east to Oxbow; then it turns south and crosses the international boundary in Range 34, W. of principal Meridian. After making a loop into North Dakota, it re-crosses the international boundary in Range 27, West of the 1st Meridian, and flows in a northeasterly direction to Souris, Manitoba, where it turns east, and finally joins the Assiniboine river, in Township 8, Range 16, West of the 1st Meridian.

The chief tributaries of Souris river are:—Long creek, which joins it near Estevan; Moose Mountain creek near Oxbow; North and South Antler creeks near Sourisford; Graham creek at Melita, and Pipestone creek near Souris.

This stream drains a large tract of typical western plains. The rainfall will probably average very little over fifteen inches, and is usually sufficiently divided over the year to prevent excessive run-off or floods. At times when there is an unusual amount of rainfall, and in the early spring, the water drains into the streams very rapidly and causes a flood of short duration.

There are towns, villages and farms all along the valley of this stream and its tributaries, which depend on it for a domestic and industrial water supply. The Canadian Pacific Railway is a large consumer. The town of Estevan has established a water works system, and at Weyburn several dams store water from Souris river. In North Dakota it has been proposed to divert water for irrigation purposes.

SOURIS RIVER AT WEYBURN

Location.—On SE. ¼ Sec. 20, Tp. 8, Rge. 14, W. 2nd Mer., about 200 feet south of Canadian Pacific railway depot, at Weyburn, and about fifteen feet from north abutment of dam.

Records available.—May 2, 1916, to December 31, 1916.

Gauge.—Vertical wooden staff; zero elevation maintained at 97.71 feet since establishment on May 17, 1916.

Bench-mark.—On top of north wing wall, southwest corner; assumed elevation 100.00 feet. Elevation of crest of dam north side referred to bench-mark 97.92 feet.

Channel.—One channel at all stages.

Discharge measurements.—Made during high and ordinary stages, from traffic bridge below dam; during low stages at a wading section about one mile southwest of town and below Beichel's dam.

Winter flow.—Stream freezes to bed.

Observer.—Jos. Scholes.

DISCHARGE MEASUREMENTS of Souris river at Weyburn, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
May 17	F. R. Shenstone	51.5	185.00	0.33	0.43	62.00
June 9	do	6.0	4.80	2.81	0.28	13.30
July 5	do	6.0	1.80	0.54	0.14	0.98*n*
July 25	J. R. Estey	.....	.....	.....	0.09	2.30*e*
July 28	do	6.0	1.83	1.82	0.13	3.30*n*
Aug. 15	do	6.0	0.84	1.25	0.05	1.05*n*
Sept. 6	F. R. Shenstone	.....	.....	.....	Dry	Nil
Oct. 10	do	.....	.....	.....	0.03	"
Nov. 10	do	.....	.....	.....	Dry	"

e Discharge estimated from field inspection.
n Discharge measured at Beichel's dam, 1½ miles below gauge and regular section; liable to error.

DAILY GAUGE HEIGHT AND DISCHARGE of Souris river at Weyburn, for 1916

DAY	May		June		July		August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	0.63	196	0.36	29.0	0.19	6.40	0.10	2.40	0.02	0.44	0.03	0.66
2	0.46	83	0.35	25.0	0.16	4.70	0.13	3.50	0.02	0.44	0.03	0.66
3	.....	76*e*	0.36	29.0	0.15	4.20	0.12	3.10	0.02	0.44	0.03	0.66
4	.....	68*e*	0.38	36.0	0.15	4.20	0.13	3.50	0.02	0.44	0.03	0.66
5	.....	60*e*	0.37	33.0	0.15	4.20	0.13	3.50	0.02	0.44	0.03	0.66
6	.....	52*e*	0.36	29.0	0.15	4.20	0.12	3.10	0.02	0.44	0.03	0.66
7	.....	44*e*	0.34	23.0	0.10	2.40	0.11	2.80	0.02	0.44	0.03	0.66
8	0.38	36	0.32	19.4	0.08	1.90	0.10	2.40	0.02	0.44	0.03	0.66
9	0.54	136	0.31	17.6	0.05	1.10	0.09	2.10	0.02	0.44	0.03	0.66
10	0.46	83	0.30	15.7	0.04	0.90	0.08	1.90	0.02	0.44	0.03	0.66
11	0.46	83	0.28	13.6	0.02	0.44	0.07	1.62	0.08	1.90	0.01	0.22
12	0.54	136	0.26	11.4	0.00	Nil	0.07	1.62	0.06	1.36	0.02	0.44
13	0.46	83	0.24	9.7	0.00	"	0.07	1.62	0.05	1.10	0.01	0.22
14	0.46	83	0.24	9.7	0.00	"	0.07	1.62	0.05	1.10	0.01	0.22
15	0.46	83	0.24	9.7	0.00	"	0.07	1.62	0.06	1.36	0.02	0.44
16	.....	74*e*	0.24	9.7	0.00	"	0.06	1.36	0.07	1.62	0.02	0.44
17	.....	66*e*	0.23	9.0	0.00	"	0.04	0.90	0.07	1.62	0.01	0.22
18	0.42	57	0.22	8.3	0.06	1.36	0.03	0.66	0.07	1.62	0.01	0.22
19	0.41	50	0.21	7.6	0.06	1.36	0.03	0.66	0.07	1.62	0.00	Nil
20	0.42	57	0.18	5.8	0.07	1.62	0.02	0.44	0.06	1.36	0.00	"
21	0.42	57	0.20	6.9	0.07	1.62	0.02	0.44	0.05	1.10	0.00	"
22	0.42	57	0.23	9.0	0.08	1.90	0.02	0.44	0.02	0.44	0.00	"
23	0.42	57	0.23	9.0	0.08	1.90	0.02	0.44	0.02	0.44	0.00	"
24	0.42	57	0.22	8.3	0.08	1.90	0.02	0.44	0.02	0.44	0.00	"
25	0.42	57	0.21	7.6	0.09	2.20	0.02	0.44	0.02	0.44	0.00	"
26	0.42	57	0.19	6.4	0.11	2.80	0.02	0.44	0.02	0.44	0.02	0.44
27	0.42	57	0.18	5.8	0.11	2.80	0.02	0.44	0.02	0.44	0.01	0.22
28	0.41	50	0.16	4.7	0.14	3.80	0.02	0.44	0.02	0.44	0.01	0.22
29	0.39	40	0.16	4.7	0.12	3.10	0.02	0.44	0.02	0.44	0.01	0.22
30	0.39	40	0.21	7.6	0.10	2.40	0.02	0.44	0.02	0.44	0.01	0.22
31	0.38	36	.....	.....	0.09	2.10	0.02	0.44	.....	.....	0.01	0.22

No water flowing after Oct. 31, though water standing in pools.
e Estimated discharge.

MONTHLY DISCHARGE of Souris river at Weyburn, for 1916

MONTH	DISCHARGE IN SECOND-FEET			RUN-OFF
	Maximum	Minimum	Mean	Total in Acre-feet
May	196.00	36.00	70.00	4,304
June	36.00	4.70	14.00	833
July	6.40	Nil	2.10	129
August	3.50	0.44	1.46	90
September	1.90	0.44	0.80	48
October	0.66	Nil	0.34	21
The period	.....	.....	.....	5,425

LONG CREEK NEAR ESTEVAN

Location.—On SE. ¼ Sec. 10, Tp. 2, Rge. 8, W. 2nd Mer., two and one-half miles south of the town of Estevan.

Records available.—June 22, 1911, to December 31, 1916.

Gauge.—Vertical staff at old section at bridge; maintained at elevation 83.87 feet during 1911-12; at 83.90 feet in 1913, and at 83.87 feet in 1914-15. Vertical staff above weir used in winter time; zero of staff at elevation of crest. Vertical staff below a beaver dam used June 21, 1915, to December 31, 1916; zero elevation 83.20 feet.

Bench-marks.—Permanent iron bench-mark near bridge at old section: assumed elevation 100.00 feet. Top of three-inch stump on left bank, 42 feet up stream from last gauge mentioned; elevation 93.15 feet.

Channel.—Permanent.

Discharge measurements.—By wading at new section or by weir.

Winter flow.—By a 24-inch rectangular weir.

Observer.—Geo. Pawson.

DISCHARGE MEASUREMENTS of Long creek near Estevan, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. pr sec.*	*Feet*	*Sec.-ft.*
Jan. 12	F. R. Shenstone	.....	.....	.....	0.17	0.46*w*
Feb. 15	do	.....	.....	.....	0.16	0.42*w*
Mar. 14	do	.....	.....	.....	0.17	0.46*w*
April 5	do	.....	.....	.....	0.47	2.04*w*
May 18	do	20.0	27.00	1.20	2.67	33.00
June 9	do	19.5	21.00	0.93	2.27	19.90
July 7	do	19.0	19.00	0.92	2.14	17.50
July 25	J. R. Estey	17.0	10.30	0.47	1.50	4.80
Aug. 15	do	15.0	8.40	0.49	1.43	4.10
Sept. 8	F. R. Shenstone	9.6	1.56	0.55	1.24	0.86
Oct. 7	do	13.0	4.10	0.41	1.54	1.69
Nov. 11	do	14.0	5.00	0.46	1.58	2.30
Nov. 25	do	13.0	4.60	0.41	1.63	1.81
Dec. 22	do	11.5	3.95	0.37	1.31	1.48

w Weir measurement.

DAILY GAUGE HEIGHT AND DISCHARGE of Long creek near Estevan, for 1916

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	0.25	0.39	0.17	0.39	0.22	0.39	0.25	0.70*s*	9.10	280	2.30	21.0
2	0.23	0.39	0.18	0.39	0.22	0.39	0.25	0.90	7.96	236	2.25	19.7
3	0.21	0.39	0.18	0.39	0.22	0.39	0.30	1.40	.....	176*e*	2.20	18.4
4	0.20	0.39	0.18	0.39	0.18	0.39	0.36	1.60	4.85	116	2.10	15.8
5	0.22	0.39	0.15	0.39	0.15	0.39	0.34	2.05	4.30	95	2.00	13.6
6	0.22	0.39	0.12	0.39	0.16	0.39	0.19	1.00	3.85	77	2.01	13.8
7	0.21	0.39	0.10	0.39	0.15	0.39	0.45	1.40	3.50	64	2.18	17.8
8	0.18	0.39	0.08	0.39	0.14	0.39	0.46	1.20	3.40	60	2.29	21.0
9	0.18	0.39	0.08	0.39	0.13	0.39	1.50	5.70	3.30	56	2.26	20.0
10	.....	0.39*e*	0.08	0.39	0.10	0.39	1.38	4.00	3.25	55	2.20	18.4
11	0.17	0.39	0.08	0.39	0.12	0.39	1.00	2.00*s*	3.22	54	2.14	16.8
12	0.23	0.39	0.10	0.39	0.15	0.39	9.96	313.00	3.14	50	2.08	15.4
13	0.12	0.39	0.12	0.39	0.16	0.39	12.30	403.00	3.05	47	2.02	13.8
14	0.22	0.39	0.13	0.39	0.16	0.39	15.05	509.00	3.00	45	2.25	19.7
15	0.12	0.39	0.13	0.39	0.17	0.39	14.36	482.00	2.97	44	2.20	18.4
16	0.13	0.39	0.19	0.39	0.18	0.39	13.70	457.00	2.94	43	2.11	16.1
17	0.12	0.39	0.19	0.39	0.17	0.39	13.45	447.00	2.90	41	2.05	14.7
18	0.12	0.39	0.19	0.39	0.16	0.39	12.69	418.00	2.75	36	2.00	13.6
19	0.12	0.39	0.21	0.39	0.17	0.39	15.05	509.00	2.63	32	1.94	12.2
20	0.12	0.39	0.22	0.39	0.17	0.39	.....	491.00*e*	2.60	30	1.86	10.6
21	0.13	0.39	0.21	0.39	0.18	0.39	.....	473.00*e*	2.55	29	1.84	10.2
22	0.13	0.39	0.21	0.39	0.18	0.39	.....	455.00*e*	2.58	30	1.95	12.4
23	0.14	0.39	0.22	0.39	0.19	0.39	.....	437.00*e*	2.55	29	2.05	14.7
24	0.10	0.39	0.22	0.39	0.17	0.39	.....	419.00*e*	2.50	27	2.04	14.5
25	0.10	0.39	0.22	0.39	.....	0.39*e*	.....	401.00*e*	2.50	27	2.01	13.8
26	0.08	0.39	0.24	0.39	0.19	0.39	.....	383.00*e*	2.45	26	1.99	13.3
27	0.08	0.39	0.23	0.39	0.17	0.39	.....	365.00*e*	2.42	25	2.04	14.5
28	.....	0.39*e*	0.22	0.39	0.24	0.39	.....	347.00*e*	2.36	23	2.05	14.7
29	0.13	0.39	0.25	0.39	0.24	0.39	.....	330.00*e*	2.30	21	1.98	13.1
30	0.13	0.39	.....	.....	0.22	0.39	9.96	313.00	2.27	20	2.55	29.0
31	0.14	0.39	.....	.....	0.25	0.39	.....	.....	2.35	23	.....	.....

e Discharge estimated.
s-s Shifting conditions.

DAILY GAUGE HEIGHT AND DISCHARGE of Long creek near Estevan, for 1916—*Concluded*

Day	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.45	26.0	1.61	6.3	1.24	1.12	1.44	1.64	1.65	2.30	1.64	2.30
2	2.45	26.0	1.62	6.4	1.20	1.06	1.45	1.67	1.64	2.30	1.63	2.20
3	2.30	21.0	1.55	5.6	1.20	1.06	1.47	1.73	1.63	2.20	1.61	2.20
4	2.23	19.2	1.55	5.6	1.20	1.06	1.55	1.97	1.57	2.00	1.62	2.20
5	2.22	18.9	1.52	5.2	1.20	1.06	1.53	1.91	1.57	2.00	1.63	2.20
6	2.15	17.0	1.55	5.6	1.22	1.09	1.53	1.91	1.57	2.00	1.63	2.20
7	2.15	17.0	1.65	6.8	1.23	1.11	1.53	1.91	1.55	1.97	1.63	2.20
8	2.10	15.8	1.63	6.5	1.23	1.11	1.53	1.91	1.60	2.10	1.61	2.20
9	1.95	12.4	1.60	6.2	1.23	1.11	1.56	2.00	1.59	2.10	1.63	2.20
10	1.88	10.9	1.56	5.7	1.23	1.11	1.58	2.10	1.58	2.10	1.60	2.10
11	1.83	10.0	1.54	5.5	1.23	1.11	1.57	2.00	1.57	2.00	1.60	2.10
12	1.79	9.3	1.50	5.0	1.26	1.16	1.56	2.00	1.59	2.10	1.62	2.20
13	1.76	8.8	1.46	4.7	1.26	1.16	1.61	2.20	1.60	2.10	1.59	2.10
14	1.70	7.7	1.46	4.7	1.28	1.19	1.64	2.30	1.62	2.20	1.51	1.85
15	1.64	6.7	1.42	4.3	1.28	1.19	1.72	2.60	1.63	2.20	1.41	1.55
16	1.58	6.0	1.40	4.2	1.29	1.20	1.70	2.50	1.63	2.20	1.45	1.67
17	1.58	6.0	1.39	4.1	1.30	1.22	1.66	2.30	1.63	2.20	1.52	1.88
18	1.53	5.4	1.36	3.8	1.32	1.28	1.64	2.30	1.65	2.30	1.54	1.94
19	1.49	5.0	1.34	3.7	1.33	1.31	1.62	2.20	1.63	2.20	1.54	1.94
20	1.48	4.9	1.29	3.3	1.35	1.37	1.59	2.10	1.63	2.20	1.51	1.85
21	1.48	4.9	1.29	3.3	1.34	1.34	1.61	2.20	1.64	2.30	1.31	1.25
22	1.48	4.9	1.26	3.1	1.35	1.37	1.61	2.20	1.62	2.20	1.32	1.28
23	1.48	4.9	1.24	3.0	1.36	1.40	1.60	2.10	1.63	2.20	1.24	1.12
24	1.48	4.9	1.24	3.0	1.38	1.46	1.60	2.10	1.64	2.30	1.30	1.22
25	1.49	5.0	1.23	2.9	1.42	1.58	1.61	2.20	1.63	2.20	1.14	0.98
26	1.46	4.7	1.23	2.9	1.44	1.64	1.62	2.20	1.65	2.30	1.15	0.99
27	1.44	4.5	1.21	2.8	1.45	1.67	1.62	2.20	1.64	2.30	1.13	0.96
28	1.44	4.5	1.20	2.8	1.46	1.70	1.64	2.30	1.63	2.20	1.10	0.91
29	1.43	4.4	1.20	2.8	1.46	1.70	1.63	2.20	1.62	2.20	1.12	0.94
30	1.43	4.4	1.20	2.8	1.45	1.67	1.65	2.30	1.64	2.30	1.11	0.92
31	1.61	6.3	1.24	3.0			1.81	3.00			1.10	0.91

MONTHLY DISCHARGE of Long creek near Estevan, for 1916

(Drainage area 1,380 square miles)

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	0.39	0.39	0.39	0.0004	0.0005	24
February	0.39	0.39	0.39	0.0004	0.0004	22
March	0.39	0.39	0.39	0.0004	0.0005	24
April	509.00	0.70	269.00	0.1950	0.2200	16,007
May	280.00	20.00	62.00	0.0450	0.0500	3,812
June	29.00	10.20	16.00	0.0120	0.0130	952
July	26.00	4.40	9.90	0.0140	0.0200	609
August	6.80	2.80	4.40	0.0030	0.0030	270
September	1.70	1.06	1.30	0.0010	0.0010	77
October	3.00	1.64	2.10	0.0020	0.0020	129
November	2.30	1.97	2.20	0.0020	0.0020	131
December	2.30	0.91	1.71	0.0010	0.0010	105
The year					0.2934	22,162

MEAN MONTHLY DISCHARGE in Second-feet of Long creek near Estevan

MONTH	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	25.00*b*	4.30	3.00	2.20	0.51	2.10	2.40	147
November	.....	.....	4.40*g*	.....	1.04	0.93	2.20	1.39	83
December	.....	.....	.....	.....	0.91	0.74	1.71	1.12	69
January	.....	.....	.....	.....	1.11	0.39	.....	0.75	46
February	.....	.....	.....	.....	1.01	0.39	.....	0.70	39
March	.....	.....	56.00*h*	.....	1.63	0.39	.....	1.01	62
April	.....	114.00*c*	78.00	61.00*k*	3.11	269.00	.....	117.00	6,937
May	.....	220.00*d*	10.50	32.00	1.28	62.00	.....	26.00	1,626
June	9.30*a*	50.00*e*	6.70	66.00	0.70	16.00	.....	22.00	1,329
July	1.63	13.00*f*	10.50	11.10	0.98	9.90	.....	6.80	419
August	0.72	4.00	1.47	1.52	0.38	4.40	.....	2.10	128
September	0.56	28.50	2.70	4.70	0.28	1.30	.....	2.10	122
Total in acre-feet	343	13,107	7,273	8,951	883	21,929	.....	.....	11,007

a 22-30.
b 1-30.
c 15-30.
d 21 days only, high water omitted.
e 1-25.
f 18-20.
g 1-15.
h 29-31.
k 16-30.

SOURIS RIVER NEAR ESTEVAN

Location.—On NE. ¼ Sec. 11, Tp. 2, Rge. 8, W. 2nd Mer., near the pumping plant of the Canadian Pacific Railway Company.

Records available.—June 23, 1911, to December 31, 1916.

Gauge.—Staff. Zero elevation of gauge was maintained at 82.45 feet during 1911-12; zero elevation of gauge was maintained at 82.55 feet during 1913-16.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.

Channel.—Subject to debris on control.

Discharge measurements.—From bridge about one mile up stream, by wading at gauge, or by weir.

Winter flow.—Affected by ice. Permanent weir used winter of 1914-16.

Observer.—W. Bevan.

DISCHARGE MEASUREMENTS of Souris river near Estevan, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Jan. 12	F. R. Shenstone	2.5	0.95	0.52	0.68	0.49
Feb. 15	do	3.6	0.87	0.53	1.24	0.47
Mar. 14	do	4.9	1.28	0.53	1.44	0.68
April 5	do	4.9	2.24	1.76	2.22	4.00
May 18	do	69.0	96.20	1.32	3.68	127.00
June 9	do	26.5	24.10	2.18	2.50	53.00
July 7	do	22.0	19.80	1.98	2.13	39.00
July 25	J. R. Estey	17.0	12.40	1.52	1.59	18.80
Aug. 15	do	11.0	7.05	1.47	1.32	10.40
Sept. 8	F. R. Shenstone	10.0	3.30	1.00	1.10	3.30
Oct. 7	do	4.7	1.95	1.87	1.22	3.60
Nov. 11	do	5.2	2.47	1.50	1.15	3.70
Nov. 25	do	5.0	1.95	1.07	1.05	2.10
Dec. 22	do	4.7	2.03	0.50	0.94	1.03

DAILY GAUGE HEIGHT AND DISCHARGE of Souris river near Estevan, for 1916

DAY	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	0.78	0.58	0.90	0.80	1.60	2.30	2.40	4.8	14.88	981	2.60	59
2	0.78	0.58	0.90	0.80	1.65	2.40	2.40	4.8	13.44	871	2.55	57
3	0.77	0.57	0.96	0.92	1.68	2.50	2.40	4.8	12.40	792	2.50	54
4	0.76	0.56	0.98	0.96	1.70	2.60	2.45	5.0	10.39	638	2.50	54
5	0.76	0.56	1.00	1.00	1.72	2.70	2.20	4.1	6.84	367	2.50	54
6	0.76	0.56	1.20	1.40	1.76	2.80	2.30	4.4	5.60	272	2.53	56
7	0.75	0.55	1.30	1.60	1.80	2.90	2.44	5.0	5.10	234	2.55	57
8	0.74	0.54	1.25	1.50	1.80	2.90	2.44	5.0	6.05	307	2.60	59
9	0.65	0.45	1.20	1.40	1.72	2.70	4.50	188.0	6.05	307	2.61	60
10	0.68	0.48	1.20	1.40	1.55	2.20	6.00	303.0	6.05	307	2.62	60
11	0.68	0.48	1.20	1.40	1.36	1.72	8.20	471.0	5.80	288	2.40	49
12	0.70	0.50	1.20	1.40	1.40	1.80	9.50	570.0	4.55	192	2.30	45
13	0.72	0.52	1.21	1.42	1.45	1.90	11.00	685.0	4.05	154	2.20	41
14	0.72	0.52	1.22	1.44	1.42	1.84	12.90	830.0	3.75	131	2.20	41
15	0.72	0.52	1.24	1.48	1.40	1.80	14.20	929.0	3.95	147	2.20	41
16	0.74	0.54	1.26	1.52	1.38	1.76	.....	1,148.0*e*	4.00	150	2.15	38
17	0.74	0.54	1.28	1.56	1.38	1.76	.....	1,317.0*e*	4.00	150	2.15	38
18	0.74	0.54	1.30	1.60	1.40	1.80	20.18	1,386.0	3.68	126	2.10	36
19	0.76	0.56	1.35	1.70	1.40	1.80	20.13	1,382.0	3.50	114	2.05	34
20	0.76	0.56	1.36	1.72	1.48	1.96	20.10	1,380.0	3.45	110	2.00	32
21	0.78	0.58	1.38	1.76	1.56	2.20	20.03	1,375.0	3.40	107	2.00	32
22	0.80	0.60	1.40	1.80	1.80	2.90	19.98	1,371.0	3.30	101	2.00	32
23	0.80	0.60	1.43	1.86	1.86	3.10	19.38	1,325.0	3.30	101	2.25	43
24	0.82	0.64	1.46	1.92	1.90	3.20	18.98	1,294.0	3.20	94	2.20	41
25	0.82	0.64	1.50	2.00	2.10	3.80	18.48	1,256.0	3.00	82	2.20	41
26	0.84	0.68	1.50	2.00	2.12	3.90	18.08	1,226.0	2.95	78	2.05	34
27	0.84	0.68	1.50	2.00	2.20	4.10	17.88	1,210.0	2.95	78	2.00	32
28	0.84	0.68	1.56	2.20	2.32	4.50	17.53	1,184.0	3.05	85	2.00	32
29	0.84	0.68	1.58	2.20	2.35	4.60	16.58	1,111.0	2.90	76	2.00	32
30	0.86	0.72	.....	.....	2.36	4.70	16.98	1,142.0	2.80	70	2.65	62
31	0.87	0.74	.....	.....	2.38	4.70	.....	.....	2.75	67	.....	.....

e Discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of Souris river near Estevan, for 1916—*Concluded*

DAY	July		August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1....	2.45	52.0	1.54	16.9	1.06	6.4	1.15	2.6	1.30	3.20	0.95	1.80
2....	2.35	47.0	1.54	16.9	1.05	6.2	1.18	2.7	1.22	2.90	0.94	1.76
3....	2.25	43.0	1.47	15.2	1.05	6.2	1.20	2.8	1.25	3.00	0.94	1.76
4....	2.20	41.0	1.45	14.7	1.06	6.4	1.20	2.8	1.20	2.80	0.95	1.80
5....	2.18	40.0	1.45	14.7	1.07	6.6	1.20	2.8	1.18	2.70	0.95	1.80
6....	2.17	39.0	1.44	14.5	1.07	6.6	1.21	2.8	1.17	2.70	0.94	1.76
7....	2.13	38.0	1.43	14.2	1.07	6.6	1.20	2.8	1.15	2.60	0.94	1.76
8....	2.05	34.0	1.45	14.7	1.10	2.4	1.20	2.8	1.15	2.60	0.94	1.76
9....	2.03	34.0	1.45	14.7	1.10	2.4	1.21	2.8	1.16	2.60	0.94	1.76
10....	2.00	32.0	1.44	14.5	1.10	2.4	1.21	2.8	1.14	2.60	0.94	1.76
11....	2.00	32.0	1.42	14.0	1.11	2.4	1.22	2.9	1.15	2.60	0.94	1.76
12....	1.90	29.0	1.37	12.8	1.11	2.4	1.22	2.9	1.10	2.40	0.90	1.60
13....	1.85	27.0	1.35	12.3	1.12	2.5	1.22	2.9	1.08	2.30	0.88	1.52
14....	1.80	25.0	1.35	12.3	1.12	2.5	1.24	3.0	1.06	2.20	0.88	1.52
15....	1.78	24.0	1.30	11.1	1.14	2.6	1.25	3.0	1.01	2.00	0.86	1.44
16....	1.73	23.0	1.30	11.1	1.14	2.6	1.25	3.0	1.00	2.00	0.88	1.52
17....	1.72	23.0	1.30	11.1	1.12	2.5	1.25	3.0	1.00	2.00	0.85	1.40
18....	1.70	22.0	1.25	10.1	1.10	2.4	1.26	3.0	1.00	2.00	0.84	1.36
19....	1.65	20.0	1.20	9.1	1.10	2.4	1.28	3.1	0.98	1.92	0.83	1.32
20....	1.65	20.0	1.20	9.1	1.10	2.4	1.30	3.2	0.98	1.92	0.83	1.32
21....	1.64	20.0	1.15	8.1	1.12	2.5	1.30	3.2	0.98	1.92	0.94	1.76
22....	1.62	19.3	1.10	7.1	1.10	2.4	1.28	3.1	0.98	1.92	0.96	1.84
23....	1.61	19.0	1.05	6.2	1.10	2.4	1.28	3.1	0.98	1.92	1.00	2.00
24....	1.60	18.7	1.05	6.2	1.10	2.4	1.26	3.0	0.98	1.92	0.90	1.60
25....	1.59	18.4	1.06	6.4	1.12	2.5	1.24	3.0	0.95	1.80	0.86	1.44
26....	1.58	18.1	1.06	6.4	1.12	2.5	1.24	3.0	0.94	1.76	0.86	1.44
27....	1.55	17.1	1.06	6.4	1.13	2.5	1.23	2.9	0.94	1.76	0.70	1.00
28....	1.65	20.0	1.06	6.4	1.15	2.6	1.23	2.9	0.94	1.76	0.64	0.88
29....	1.55	17.1	1.06	6.4	1.15	2.6	1.22	2.9	0.95	1.80	0.60	0.80
30....	1.54	16.9	1.06	6.4	1.15	2.6	1.22	2.9	0.95	1.80	0.55	0.70
31....	1.53	16.6	1.06	6.4	.....	.....	1.25	3.0	.....	.....	0.54	0.68

MONTHLY DISCHARGE of Souris river near Estevan, for 1916

(Drainage area 4,550 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
January	0.74	0.45	0.58	0.0001	0 0001	36
February	2.20	0.80	1.55	0.0003	0.0003	89
March	4.70	1.72	2.80	0.0006	0.0007	172
April	1,386.00	4.10	771.00	0.1690	0.1900	45,878
May	981.00	67.00	244.00	0.0540	0.0600	15,003
June	60.00	32.00	45.00	0.0100	0.0100	2,678
July	52.00	16.60	27.00	0.0060	0.0070	1,660
August	16.90	6.20	10.80	0.0020	0.0020	664
September	6.60	2.40	3.40	0.0007	0.0008	202
October	3.20	2.60	2.90	0.0006	0.0007	178
November	3.20	1.76	2.20	0.0005	0.0006	131
December	1.80	0.68	1.52	0.0003	0.0003	93
The year	.....	.....	.....	.....	0.2725	66,784

MEAN MONTHLY DISCHARGE in Second-feet of Souris river near Estevan

MONTH	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	34.0	6.70	1.05	1.35	0.05	2.90	7.60	470
November	.....	19.1*b*	4.40	2.20	0.76	0.43	2.20	2.00	119
December	.....	.....	2.30	0.96	1.00	0.72	1.52	1.30	79
January	.....	.....	0.18	0.30	1.01	0.58	.....	0.52	32
February	.....	.....	2.40	0.50	1.85	1.55	.....	1.58	88
March	.....	.....	44.00	86.00	1.86	2.80	.....	34.00	2,070
April	.....	.....	410.00	229.00	3.00	771.00	.....	353.00	21,016
May	.....	.....	17.30	65.00	1.96	244.00	.....	82.00	5,046
June	12.20*a*	20.0*c*	12.40	155.00	0.99	45.00	.....	53.00	3,174
July	4.40	13.2	21.00	14.40	1.20	27.00	.....	13.50	836
August	1.49	5.2	4.20	2.20	0.28	10.80	.....	4.00	248
September	1.91	3.0	0.66	0.83	0.04	3.40	.....	1.64	98
Total in acre-ft.	670	4,194	31,457	33,506	919	66,455	.....	.....	33,276

a 23-30.
b 1-15.
c 25-30.

MOOSE MOUNTAIN CREEK NEAR OXBOW

Location.—On NE. ¼ Sec. 15, Tp. 3, Rge. 2, W. 2nd Mer., one mile south and one-half mile west of the Canadian Pacific railway station at Oxbow.

Records available.—September 4, 1913, to October 11, 1916.

Gauge.—Vertical staff; zero elevation 91.94 feet from establishment until August 23, 1915, sometimes affected by backwater from Souris river. Vertical staff; zero elevation 92.31 feet, August 24, 1915, to October 31, 1916.

Bench-marks.—On stump of tree, fifty feet up stream from first gauge, painted white; assumed elevation 100.00 feet. Spike in tree on right bank at second gauge; elevation 98.84 feet.

Channel.—Permanent.

Discharge measurements.—By wading near first gauge or from bridge one-quarter mile up stream.

Winter flow.—No winter observations have been taken.

Observer.—Miss Flora Christmas.

DISCHARGE MEASUREMENTS of Moose Mountain creek near Oxbow, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
May 19	F. R. Shenstone	23.5	40.60	1.64	2.74	67.00
June 10	do	23.3	33.80	1.61	2.46	55.00
July 6	do	23.0	32.80	1.52	2.45	50.00
July 26	J. R. Estey	21.5	12.10	0.74	1.45	9.00
August 16	do	15.0	10.50	0.48	1.31	5.10
September 7	F. R. Shenstone	.....	.....	.....	0.87	0.10*e*
October 9	do	4.5	1.32	0.59	1.05	0.77

e Discharge estimated; too small to measure.

DAILY GAUGE HEIGHT AND DISCHARGE of Moose Mountain creek near Oxbow; for 1916

DAY	April		May		June		July	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	6.32	246	2.63	62	2.74	67.0
2	.....	.....	5.95	228	2.59	60	2.71	66.0
3	.....	.....	5.76	218	2.43	52	2.69	64.0
4	.....	.....	5.60	210	2.52	56	2.54	57.0
5	.....	.....	5.13	186	2.53	56	2.48	54.0
6	.....	.....	4.77	168	2.48	54	2.45	53.0
7	.....	.....	4.35	148	.....	54*e*	2.38	49.0
8	3.34	.....	3.80	120	2.45	53	2.32	46.0
9	3.53	.....	3.53	106	.....	52*e*	2.25	43.0
10	3.38	.....	3.53	106	2.44	52	2.37	49.0
11	3.74	.....	3.29	94	2.40	50	2.14	38.0
12	4.44	.....	3.15	88	2.38	49	2.04	33.0
13	5.90	.....	3.13	86	2.34	47	1.84	24.0
14	7.90	.....	2.95	78	2.30	45	1.82	23.0
15	.....*g*	.....	2.90	75	2.35	48	1.70	18.1
16	.....	.....	2.81	70	2.30	45	1.68	17.3
17	.....	.....	2.78	69	2.25	43	1.60	14.3
18	8.40*g*	.....	2.78	69	2.18	40	1.70	18.1
19	8.41	350	2.74	67	2.10	36	1.86	25.0
20	8.45	352	2.69	64	2.05	33	1.63	15.4
21	10.55	458	2.64	62	2.05	33	1.63	15.4
22	10.65	460	2.74	67	2.49	54	1.55	12.5
23	10.85	472	2.69	64	2.55	58	.....	11.0*e*
24	10.47	454	2.63	62	2.45	53	1.50	10.7
25	9.78	419	2.62	61	2.35	48	1.45	9.0
26	9.08	384	2.59	60	2.24	42	1.44	8.7
27	8.45	352	2.73	66	2.15	38	1.43	8.4
28	7.81	320	2.62	61	.....	45*e*	1.50	10.7
29	7.23	292	2.61	60	2.44	52	.....	10.0*e*
30	5.81	220	2.53	56	2.85	72	1.45	9.0
31	.....	.....	2.59	60	.....	.....	1.43	8.4

g-g Ice going out.
e Discharge estimated.
Not sufficient data to estimate discharge during spring break-up.

DAILY GAUGE HEIGHT AND DISCHARGE of Moose Mountain creek near Oxbow, for 1916—*Concluded*

DAY	August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	1.34	6.00	0.91	0.12	0.90	0.10
2	1.30	5.00	0.91	0.12	0.96	0.24
3	1.28	4.60	0.92	0.14	1.05	0.80
4	1.30	5.00	0.91	0.12	1.07	1.04
5	1.29	4.80	0.90	0.10	1.07	1.04
6	1.37	6.80	.....	0.10*e*	1.08	1.16
7	1.32	5.50	0.87	0.10	1.09	1.28
8	1.51	11.10	0.87	0.10	1.06	0.92
9	.....	12.00*e*	0.86	0.10	1.01	0.48
10	1.60	14.30	.....	0.10*e*	1.21	3.20
11	1.59	13.90	0.87	0.10	1.22	3.40
12	1.58	13.60	0.87	0.10	1.24	3.80
13	1.59	13.90	0.87	0.10	1.25	4.00
14	1.38	7.00	0.86	0.10	1.28	4.60
15	1.30	5.00	0.86	0.10	1.29	4.80
16	1.28	4.60	0.86	0.10	1.30	5.00
17	1.21	3.20	0.86	0.10	1.33	5.70
18	1.19	2.80	0.86	0.10	1.35	6.20
19	1.14	1.96	0.86	0.10	1.39	7.30
20	1.10	1.40	0.87	0.10	1.37	6.80
21	1.09	1.28	0.84	0.10	1.35	6.20
22	1.09	1.28	0.83	0.10	1.37	6.80
23	1.08	1.16	0.87	0.10	1.40	7.60
24	1.08	1.16	0.87	0.10	1.40	7.60
25	1.07	1.04	0.87	0.10	1.41	7.90
26	1.06	0.92	0.88	0.10	1.45	9.00
27	1.05	0.80	0.89	0.10	1.47	9.70
28	1.05	0.80	0.89	0.10	1.48	10.00
29	0.92	0.14	0.91	0.12	1.53	11.80
30	0.92	0.14	0.91	0.12	1.51	11.10
31	0.92	0.14	.....	.....	1.54	12.10*x*

e Discharge estimated.
x Rise in October due to snow.

MONTHLY DISCHARGE of Moose Mountain creek near Oxbow, for 1916

(Drainage area 2,953 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
April (19-30)	472.00	220.00	378.00	0.128	0.06	8,995
May	246.00	56.00	102.00	0.035	0.04	6,272
June	72.00	33.00	49.00	0.017	0.02	2,916
July	67.00	8.40	29.00	0.010	0.01	1,783
August	14.30	0.14	4.90	0.002	0.00	301
September	0.14	0.10	0.10	0.000	0.00	6
October	12.10	0.10	5.20	0.002	0.00	320
The period	.....	.....	.....	.....	0.13	20,593

SOURIS RIVER NEAR GLEN EWEN

Location.—On NE. ¼ Sec. 36, Tp. 2, Rge. 1, W. 2nd Mer., two miles south and one mile east of Canadian Pacific railway station at Glen Ewen.

Records available.—June 26, 1911, to October 31, 1916.

Gauge.—Vertical staff; zero maintained at elevation of 79.32 feet during 1911, and at 78.98 feet during 1912-1916.

Bench-mark.—Permanent iron bench-mark; assumed elevation 100.00 feet.
Channel.—Affected by beaver dams and debris on control.
Discharge measurements.—By wading at ford one-quarter mile below gauge, or from bridge one mile above gauge.
Winter flow.—No observations have been taken.
Observer.—D. F. Preston.

DISCHARGE MEASUREMENTS of Souris river near Glen Ewen, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
May 19	F. R. Shenstone	56.0	292.0	0.96	5.04	282.0
June 10	do	55.0	222.0	0.75	3.68	160.0
July 6	do	56.0	121.0	1.34	3.79	162.0
July 26	J. R. Estey	45.0	62.0	0.82	2.44	51.0
Aug. 16	do	44.4	52.8	0.59	2.26	31.0
Sept. 7	F. R. Shenstone	35.0	17.0	0.45	1.95	7.7
Oct. 9	do	37.0	26.3	0.41	2.22*c*	10.8

c Gauge height affected by backwater from beaver dam.

DAILY GAUGE HEIGHT AND DISCHARGE of Souris river near Glen Ewen, for 1916

Day	April		May		June		July	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	17.05	1,387	4.14	199	3.66	155
2	.....	.....	16.40	1,327	4.08	194	3.67	156
3	.....	.....	15.55	1,249	3.97	183	4.02	188
4	.....	.....	14.70	1,171	3.82	180	3.95	182
5	3.10*b*	.....	13.80	1,088	3.82	180	3.94	181
6	4.00	.....	12.90	1,005	3.77	165	3.79	167
7	4.15	.....	11.25	853	3.75	163	3.53	144
8	3.30	.....	9.60	701	3.73	161	3.44	135
9	6.55	.....	8.24	576	3.71	160	3.23	116
10	7.80	.....	7.27	487	3.69	158	3.15	109
11	7.90	.....	7.24	484	3.72	161	3.07	102
12	8.15	.....	6.74	438	3.70	159	2.95	92
13	9.26*b*	.....	6.45	412	3.57	147	2.85	83
14	12.18*g*	.....	6.28	396	3.50	141	2.78	77
15	14.30	.....	5.89	360	3.40	132	2.70	70
16	16.60*g*	.....	5.64	337	3.38	130	2.67	68
17	18.00	1,474	5.38	313	3.36	128	2.64	65
18	19.11	1,576	5.20	296	3.28	121	2.61	62
19	18.91	1,558	5.04	282	3.26	119	2.55	57
20	18.50	1,520	4.97	270	3.18	112	2.56	58
21	18.85	1,553	4.90	269	3.06	101	2.50	53
22	19.59	1,620	4.93	271	3.10	105	2.47	51
23	20.00	1,658	4.92	271	3.36	128	2.44	48
24	20.17	1,674	4.71	251	3.57	147	2.39	44
25	20.15	1,672	4.56	238	3.58	148	2.40	45
26	19.95	1,654	4.52	234	3.57	147	2.45	49
27	19.57	1,618	4.50	232	3.43	134	2.44	48
28	19.21	1,585	4.44	227	3.91	178	2.45	49
29	18.67	1,536	4.33	216	4.01	187	2.44	48
30	17.95	1,470	4.20	204	3.67	156	2.44	48
31	.....	.....	4.18	203	.....	.....	2.44	48

b-b Ice conditions.
g-g Ice going out.
Not sufficient data to estimate discharge during spring break-up, April 5-16.

DAILY GAUGE HEIGHT AND DISCHARGE of Souris river near Glen Ewen, for 1916—*Concluded*

DAY	August		September		October	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	2.44	48.00	1.86	2.3	2.13	7.6
2	2.44	48.00	1.88	2.8	2.15	9.1
3	2.35	40.00	1.90	3.4	2.16	9.6
4	2.33	39.00	1.92	5.0	2.19	11.1
5	2.31	37.00	1.97	9.1	2.16	8.6
6	2.41	46.00	1.96	8.3	2.19	10.1
7	2.39	44.00	1.95*s*	7.5	2.22	12.6
8	2.37	42.00	1.94	6.1	2.23	12.1
9	2.35	40.00	1.93	4.7	2.20	9.6
10	2.50	53.00	1.94	4.9	2.19	8.1
11	2.42	40.00	1.94	4.3	2.19	7.6
12	2.37	42.00	1.97	6.1	2.23	10.5
13	2.36	41.00	1.96	4.7	2.25	11.6
14	2.34	40.00	1.98	5.8	2.23	9.0
15	2.30	36.00	2.01	7.6	2.23	8.5
16	2.25	32.00	2.02	7.8	2.23	8.0
17	2.22	30.00	2.00	5.6	2.24	8.5
18	2.22	30.00	2.02	6.6	2.24	8.0
19	2.19	27.00	2.10	12.6	2.24	7.5
20	2.16	25.00	2.11	13.2	2.23	6.0
21	2.12	21.00	2.04	6.5	2.25	7.5
22	2.08	18.20	2.06	7.5	2.25	7.0
23	2.05	15.70	2.08	8.6	2.27	8.5
24	2.04	14.90	2.05	5.5	2.28	9.0
25	2.03	14.10	2.07	6.5	2.29	9.0
26	1.97	9.10	2.13	10.6	2.29	9.0
27	1.95	7.50	2.14	11.0	2.31	11.0
28	1.92	5.00	2.14	10.4	2.32	12.0
29	1.86	2.30	2.12	7.8	2.34	14.0
30	1.85	2.00	2.10	6.0	2.34	14.0
31	1.84	1.80	.....	.....	2.34*s*	14.0

s-s Shifting conditions due to beaver dam.

MONTHLY DISCHARGE of Souris river near Glen Ewen, for 1916

(Drainage area 7,500 square miles)

MONTH	DISCHARGE IN SECOND-FEET				RUN-OFF	
	Maximum	Minimum	Mean	Per square Mile	Depth in inches on Drainage Area	Total in Acre-feet
April (17-30)	1,674.0	1,470.00	1,583.0	0.211	0.110	43,947
May	1,387.0	203.00	518.0	0.069	0.080	31,851
June	199.0	101.00	151.0	0.020	0.020	8,985
July	188.0	44.00	90.0	0.012	0.010	5,534
August	53.0	1.80	29.0	0.004	0.005	1,783
September	13.2	2.30	7.0	0.001	0.001	417
October	14.0	6.00	9.6	0.001	0.001	590
The period	.....	.....	.....	.....	0.227	93,107

MEAN MONTHLY DISCHARGE in Second-feet of Souris river near Glen Ewen

MONTH	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	Mean in Sec.-ft.	Mean in Acre-ft.
October	.....	72.0	12.3	18.4	15.30	1.06	9.6	21.00	1,322
November	.....	53.0*b*	9.4*d*	.....	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	Nil	.....	.....	.....	.....
February	.....	.....	.....	.....	"	.....	.....	.....	.....
March	.....	.....	.....	.....	0.17	.....	.....	0.17	10
April	.....	456.0*c*	345.0*e*	373.0*g*	14.60	1,583.00*f*	.....	14.60	869
May	.....	514.0	94.0	183.0	12.80	518.00	.....	264.00	16,260
June	30.0*a*	109.0	41.0	170.0	17.60	151.00	.....	98.00	5,818
July	16.7	24.0	46.0	48.0	25.00	90.00	.....	42.00	2,561
August	14.7	15.8	17.0	9.4	3.70	29.00	.....	14.90	914
September	18.6	10.0	9.4	10.8	1.05	7.00	.....	9.50	564
Total in acre-ft.	3,338	61,650	23,972	37,768	5,453	92,583	.....	.....	28,318

a 26-30.
b 1-15.
c 15-30.
d 1-15.
e 16-30.
f 17-30.
g 16-30.

BIG QUILL LAKE DRAINAGE BASIN

SPRING CREEK NEAR WYNYARD

Location.—On SE. ¼ Sec. 30, Tp. 32, Rge. 15, W. 2nd Mer., about three miles east of Wynyard and 200 feet south of Canadian Pacific railway track.

Records available.—For part of the year 1916.

Gauge.—Vertical enamel staff, about five feet above weir.

Bench-mark.—None.

Weir.—Permanent, sharp-crested, rectangular weir, twenty-four inches wide.

Channel.—One channel during all stages; permanent.

Discharge measurements.—Made with permanent weir or from Canadian Pacific railway bridge during high stages.

Observer.—F. Cipka.

DISCHARGE MEASUREMENTS of Spring creek near Wynward, in 1916

Date	Engineer	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
Mar. 1	F. R. Shenstone	.....	.....	.....	.....*x*	0.05
April 15	do	25	50	1.02	2.90	51.00
July 15	J. R. Estey	.....	.....	.....	.....	Nil
Aug. 1	do	.....	.....	.....	0.15	0.38*w*
Aug. 20	do	.....	.....	.....	0.06	0.10*w*
Oct. 4	F. R. Shenstone	.....	.....	.....	0.07	0.12*w*
Oct. 28	do	.....	.....	.....	0.29	1.01*w*

x No gauge set.
w Weir measurement.

DAILY GAUGE HEIGHT AND DISCHARGE of Spring creek near Wynyard, for 1916

DAY	April		May		August	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	.....	.....	0.25	0.81	.....	.....
2	.....	.....	0.26	0.86	.....	.....
3	.....	.....	0.20	0.60	.....	.....
4	1.00	12.20	0.25	0.81	.....	.....
5	1.50	22.00	0.26	0.86	.....	.....
6	1.55	23.00	0.25	0.81	.....	.....
7	1.60	24.00	0.24	0.76	0.12	0.28
8	1.62	25.00	0.21	0.65	0.12	0.28
9	1.70	26.00	0.20	0.60	0.14	0.35
10	1.90	31.00	0.25	0.81	0.11	0.24
11	1.90	31.00	0.25	0.81	0.11	0.24
12	1.90	31.00	0.24	0.76	0.00	0.00
13	2.00	33.00	0.24	0.76	0.03	0.03
14	2.10	35.00	0.24	0.76	0.03	0.03
15	2.90	51.00	0.20	0.60	0.03	0.03
16	2.60	45.00	0.20	0.60	0.03	0.03
17	2.20	37.00	0.20	0.60	0.03	0.03
18	1.90	31.00	0.18	0.50	0.03	0.03
19	1.60	24.00	0.18*x*	0.50	0.03	0.03
20	1.20	16.30	.....	.....	0.06	0.10
21	1.00	12.20	.....	.....	0.06	0.10
22	1.00	12.20	.....	.....	0.06	0.10
23	0.80	8.20	.....	.....	0.06	0.10
24	0.55	3.10	.....	.....	0.05	0.08
25	0.48	2.20	.....	.....	0.05	0.08
26	0.45	1.93	.....	.....	0.05	0.08
27	0.41	1.68	.....	.....	.....	0.09*e*
28	0.39	1.56	.....	.....	0.06	0.10
29	0.31	1.11	.....	.....	0.07	0.12
30	0.30	1.07	.....	.....	0.07	0.12
31	.....	.....	.....	.....	0.07	0.12

x Canadian Pacific railway pumping station closed; no records obtained from May 18 to Aug. 7.
e Discharge estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of Spring creek near Wynyard, for 1916—*Concluded*

DAY	September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
1	0.07	0.12	.....	0.10*e*	0.29	1.00	0.10	0.20
2	0.07	0.12	0.06	0.10	0.29	1.00	0.10	0.20
3	.....	0.12*e*	0.06	0.10	0.29	1.00	.....	0.19*e*
4	0.07	0.12	0.06	0.10	0.29	1.00	0.09	0.18
5	0.07	0.12	0.07	0.12	.....	0.77*e*	0.09	0.18
6	0.07	0.12	0.07	0.12	0.19	0.54	0.09	0.18
7	0.07	0.12	0.07	0.12	0.18	0.50	0.09	0.18
8	0.06	0.10	.....	0.20*e*	0.16	0.42	0.09	0.18
9	.....	0.10*e*	0.12	0.28	0.16	0.42	0.09	0.18
10	0.06	0.10	0.11	0.24	0.15	0.38	.....	0.18*e*
11	0.06	0.10	0.11	0.24	0.12	0.28	0.09	0.18
12	0.06	0.10	0.09	0.18	.....	0.24*e*	0.09	0.18
13	0.07	0.12	0.09	0.18	0.10	0.20	0.09	0.18
14	0.07	0.12	0.08	0.16	0.09	0.18	0.08	0.16
15	0.06	0.10	.....	0.16*e*	0.07	0.12	0.08	0.16
16	.....	0.09*e*	0.08	0.16	0.06	0.10	0.08	0.16
17	0.05	0.08	0.08	0.16	0.10	0.20	.....	0.14*e*
18	0.05	0.08	0.09	0.18	0.10	0.20	0.07	0.12
19	0.06	0.10	0.09	0.18	.....	0.20*e*	0.07	0.12
20	0.06	0.10	0.14	0.34	0.10	0.20	0.10	0.20
21	0.06	0.10	0.15	0.38	0.10	0.20	0.10	0.20
22	0.06	0.10	0.15	0.38	0.10	0.20	0.10	0.20
23	0.06	0.10	0.17	0.46	0.10	0.20	0.10	0.20
24	.....	0.10*e*	0.17	0.46	0.10	0.20	.....	0.19*e*
25	0.06	0.10	0.19	0.54	0.10	0.20	0.09	0.18
26	0.06	0.10	0.23	0.71	.....	0.20*e*	0.09	0.18
27	0.06	0.10	0.23	0.71	0.10	0.20	0.08	0.16
28	0.07	0.12	0.20	0.60	0.10	0.20	0.09	0.18
29	0.07	0.12	.....	0.60*e*	0.10	0.20	0.09	0.18
30	0.06	0.10	0.20	0.60	0.10	0.20	0.08	0.16
31	.....	.....	0.29	1.00	.....	.....	.....	0.16*e*

e Discharge estimated.

MONTHLY DISCHARGE of Spring creek near Wynyard, for 1916

MONTH	DISCHARGE IN SECOND-FEET			RUN-OFF
	Maximum	Minimum	Mean	Total in Acre-feet
April (4-30)	51.00	1.07	20.00	1,071.0
May	0.86	0.50	0.71	27.0
August	0.35	0.03	0.11	5.5
September	0.12	0.08	0.11	6.5
October	1.00	0.10	0.32	19.7
November	1.00	0.10	0.37	22.0
December	0.20	0.12	0.18	11.2
The period	.....	.....	.....	1,162.9

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